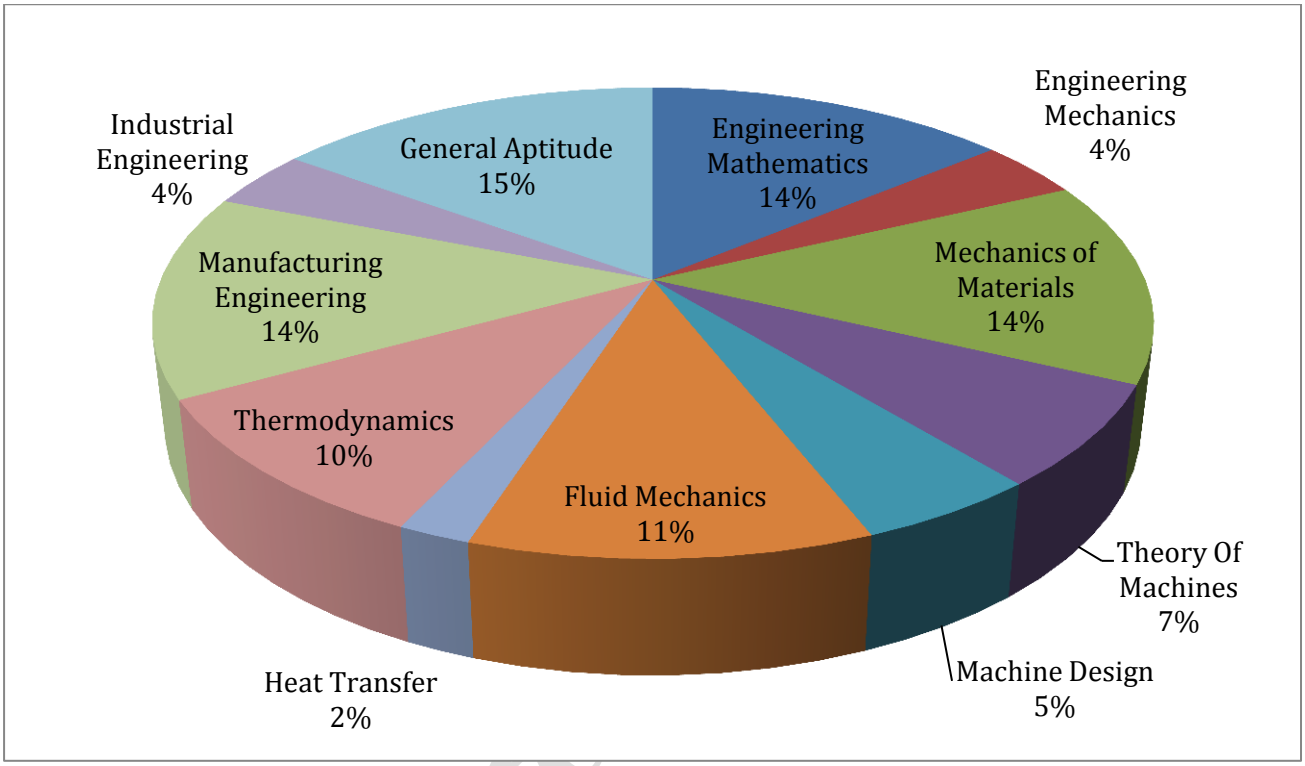
ANALYSIS OF GATE 2018*(Memory Based)

Mechanical Engineering



ME ANALYSIS-2018_3-Feb_Morning

SUBJECT	No. of Ques.	Topics Asked in Paper(Memory Based)	Level of Ques.	Total Marks
Engineering Mathematics	1 Marks: 6 2 Marks: 4	Mean Value Theorem; Probability , Euler's Method, Rank, Analytic Function, Laplace Transform	Easy	14
Engineering Mechanics	1 Marks: 0 2 Marks: 2	Slider Crank Mechanism, Collision	Medium	4
Mechanics of Materials	1 Marks: 4 2 Marks: 5	Simple Stress Strains, Analysis of Shear Stress, Stress in Beams, Plain Stress	Medium	14
Theory Of Machines	1 Marks: 3 2 Marks: 2	Gear Strain	Medium	7
Machine Design	1 Marks: 1 2 Marks: 2	Bearing Capacity, Breaks	Easy	5
Fluid Mechanics	1 Marks: 3 2 Marks: 4	Peloton Wheels,	Medium	11
Heat Transfer	1 Marks: 0 2 Marks: 1	Conduction,	Easy	2
Thermodynamics	1 Marks: 2 2 Marks: 4	Entropy, IC Engines, Steady Flow Energy Equation	Medium	10
Manufacturing Engineering	1 Marks: 6 2 Marks: 4	ECM, Sheet Metal, Metal cutting	Tough	14
Industrial Engineering	1 Marks: 0 2 Marks: 2	Linear Program	Medium	4
General Aptitude	1 Marks: 5 2 Marks: 5	Geometry, TSD, Functions, Grammar, Numbers, Work, inference	Easy	15
Total	**65**			**100**
Faculty Feedback	Majority of the question were concept based. General Aptitude And Mathematics is Very Easy. Core Subject Questions were 50% easy, 30% medium and 20% tough.			

General Aptitude

GATE 2018 Examination* (Memory Based)

Mechanical Engineering

Test Date: 3-FEB-2018

Test Time: 9:00 AM 12:00 PM

Subject Name: Mechanical Engineering

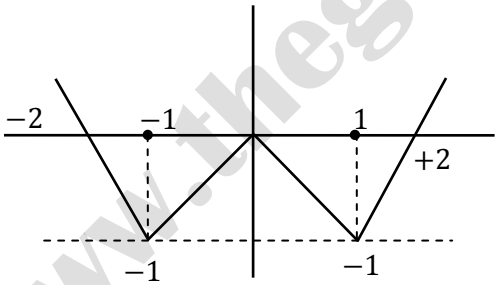
General Aptitude

Q.1 - Q.5 Carry One Mark each.

1. Her_____ should not be confused with miserliness because she is ever willing to assist those in need.
   (A) Cleanliness (B) Punctuality
   (C) Frugality (D) Greatness
   [Ans. C]

2. Going by the _____ that many hands make light work, the school _____ involved all the students in the task
   (A) Principle , Principal
   [Ans. A]

3. Find function of following graph



   (A) $\big||x|+1\big|-2$ (B) $||x|-1\,|-1$
   (C) $\big||x|+1\big|-1$ (D) $\big||x-1|-1\big|$
   [Ans. B]

4. If by decreasing length of rectangle by 10 m and breath by 5 m it becomes a square .The area lost from rectangle is 650 m^2. Find the area of original rectangle?
   (A) 1125 (B) 2250
   (C) 2924 (D) 4500
   [Ans. B]

5. 7 machines take 7 min to make 7 identical toys. At the same rate how many minutes would it take for 100 machines to make 100 toys?
(A) 1 (B) 7
(C) 100 (D) 700
[Ans. B]

Q.6 - Q.10 Carry Two Mark each.

6. If a and b are integers and $a + a^2b^3$ is odd then
(A) a and b odd (B) a and b even
(C) a even b odd (D) a odd b even
[Ans. D]

7. From the time, the front of a train enters a platform it take 25 sec for back of the train to leave the platform, if train is travelling at 54 km/hr. At the same speed it takes 14 sec to pass a man running at 9 km/h in same direction of the train. Length of train and platform in m is?
(A) 175 and 200 (B) 210 and 140
(C) 162.5 and 187.5 (D) 245 and 130
[Ans. A]

8. For integers a, b, c, minimum and maximum of $a + b + c$
If $\log|a| + \log|b| + \log|c| = 0$
(A) -3 and 3 (B) -1 and 1
(C) -1 and 3 (D) 1 and 3
[Ans. A]

9. A number consists of 2 digits, the sum of digits is 9. If 45 is subtracted from the number its digits are interchange. What is the number?
(A) 63 (B) 72
(C) 81 (D) 90
[Ans. B]

10. 1. Some roses are red
2. All red flower fade quickly
3. Some roses fade quickly
(A) If statement ① is true and statement ② is false then statement ③ is false
(B) If Statement ① true statement ② false then statement ③ is true
(C) If Statement ① true statement ② true the statement ③ true
(D) If Statement ① false statement ② false the statement ③ false statement
[Ans. C]

Technical

1. $A = \begin{bmatrix} -4 & 1 & -1 \\ -1 & -1 & -1 \\ 7 & -3 & 1 \end{bmatrix}$ find rank of A

(A) 1 (B) 2

(C) 3 (D) 4

[Ans. B]

$|A| = \begin{vmatrix} -4 & 1 & -1 \\ -1 & -1 & -1 \\ 7 & -3 & 1 \end{vmatrix}$

$-4(-1-3) - 1(-1+7) - 1(3+7)$

$= 16 - 6 - 10 = 0$

$|A| = 0$

$\text{rank}(A) \leq 2$

$\begin{vmatrix} -1 & -1 \\ -3 & 1 \end{vmatrix} = -1 - 3 = -4 \neq 0$(atleast one minor of order 2 is not equal to 0)

Rank=2

2. F(z) is a function of z and $z = x + iy$ then

$F(z) = iz + k$ Real part $(z) + i$ imaginary part of (z)

For what value of k? f(z) satisfies C − R equations

(A) 0 (B) 1

(C) −1 (D) 4

[Ans. B]

$f(z) = i(x + iy) + k(x) + i(y)$

$= x - y + k.x + iy$

$f(z) = \underbrace{(kx - y)}_{u} + \underbrace{i(x + y)}_{v},$

C-R equations

$\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y};\ k = 1$

3. Consider the function F(x) which is continuous in (a, b) there exists $'\xi' \in [a, b]$ such that $\int_a^b f(x)\,dx$ is _____

(A) $f(\xi)(b - a)$ (B) $f(b)(\xi - a)$

(C) $f(a)(b - \xi)$ (D) 0

[Ans. A]

$f(x) \in [a, b]$

$\xi \in [a, b]$

MVT of integrals

$f(\xi) = \frac{1}{b - a} \int_a^b f(x)\,dx$

$\Rightarrow \int_a^b f(x)dx = (b - a)f(\xi)$

4. An explicit forward Euler method is used to numerically solve differential equation $\frac{dy}{dt} = y$ using time step of 0.1 with initial condition $y(0) = 1$
$y(1)$ computed by this method is $y_3 = y(0.3) = (1.1)(1.1)(1.1)$
$y_{n+1} = y_n + hf(t_n, y_n)$ $y_{10} = y(1) = (11)^{10} = 2.59$
$f(t,y) = \frac{dy}{dt} = y$
$y_{n+1} = y_n + h\, y_n$
$= (1+h)y_n$
$h = 0.1$
$y_1 = y(0.1)$
$y_2 = y(0.2) = (1+0.1)y_1 = (1.1)(1.1)$

3. $\oiint_s \bar{r}.\hat{n}\, ds = ?$ Over the closed surface 'S' bounding the volume 'V' where $r = x\hat{i} + y\hat{j} + z\hat{k}$ is the position vector
(A) 1V (B) 2V
(C) 3V (D) 4V
[Ans. C]

4. Let x_1, x_2 be two normal random (independent) variables with means μ_1, μ_2 and standard deviation σ_1, σ_2, consider $y = x_1 - x_2$ is random variable then _____ (given that $\mu_1 = \mu_2 = 1, \sigma_1 = 1, \sigma_2 = 2$)
(A) Y is normal distributed random variable with mean=0, variance=1
(B) Y is normal distributed random variable with mean=0, variance=5
(C) Y is not normal distributed random variable with mean =0, variance =1
(D) Y is not normal distributed random variable with mean=0, variance =5
[Ans. B]

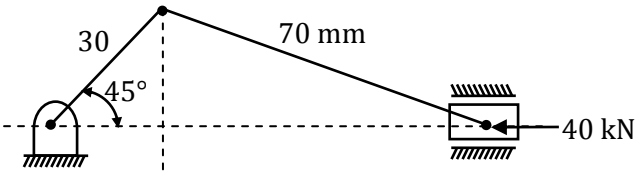
5. A six faced fair die is rolled 5 times then percentage probability of obtaining '1' at least 4 times is
(A) 33 (B) 3.33
(C) 0.33 (D) 0.0033
[Ans. C]

6. A box contains 4 Red, 4 Green, 4 Black balls, 3 balls are pulled out of the box at random one after another without replacement . probability of getting all 3 balls are red.
(A) $\frac{1}{72}$ (B) $\frac{1}{55}$
(C) $\frac{1}{36}$ (D) $\frac{1}{27}$
[Ans. B]

7. F(s) is the L.T of $f(t) = 2t^2\, e^{-t}$ then find $F(1) = 0.5$
[Ans. *]Range: 0.5 to 0.5

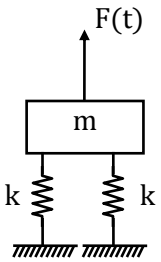
8. In a slider crank mechanism, crank is of length 30 mm and connecting rod is of length 70 mm. At the instant
[Ans. *]

9. In a slider crank mechanism, crank is of length 30 mm and connecting rod is of length 70 mm. At the instant when crank is making 45° with the line of reciprocation of slider what will be the turning moment (N.m) on crank if a force of 40 kN is applied on the slider as shown ?



[Ans. *]Range: 1118.33 to 1118.33

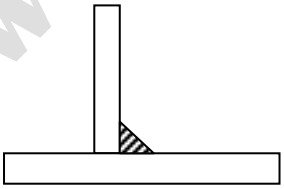
10. A mass 200 kg is supported with two springs of stiffness k=10 kN/m and subjected to a harmonic force F(t) =50 let 5t. find the magnitude of dynamic force transmitted from each mounting to the ground



[Ans. *]

11. For minimum Value of 3x+5y
So that
3x+5y≤15,
4x+9y≤8;
13x+2y≤2;
X≥o;
Y≥0.
[Ans. *] Range: 0 to 0

12. Below is figure shown what the name of weld based on shaded region.

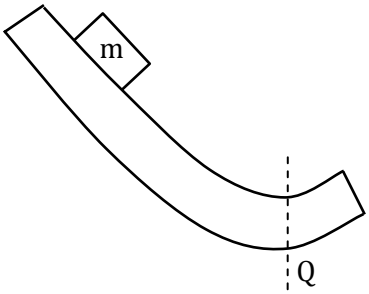


(A) Fillet weld
(B) Groove weld
(C) Spot weld
(D) Plug weld

13. A block of mass 2 kg is sliding along a curved surface from P. At point Q, it's vecity is 20 m/s and radius of curvature is 2 m. What will be the normal force acting block at Q?

[Ans. *]Range: 420 to 420

FBD of block Q



By,

$\sum F = ma$

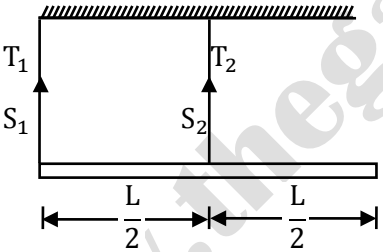
$N\text{-}mg = m \cdot \frac{V^2}{R}$

$\Rightarrow N = m\left[\frac{V^2}{R} + g\right]$

$N = 2\left[\frac{20^2}{2} + 10\right]$

$N = 420\ N$

14. A rigid bar of weight 100 N and length L is supported to a fix support with the help of two strings S_1 and S_2. At equilibrium, what is the magnitude of tension developed in strings T_1 and T_2?

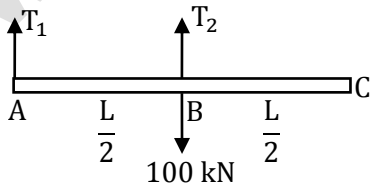


(A) 100 N, 0 N

(B) 0 N, 100 N

[Ans. B]

From the FBD of rigid bar,



Let,

$\sum M_A = 0$

$-T_2 \times \frac{L}{2} + 100 \times \frac{L}{2} = 0$

$T_2 = 100\ N$

$\sum F_y = 0$

$T_1 + T_2 - 100 = 0$

$T_1 = 100 - T_2 = 0$

$T_1 = 0\ N$

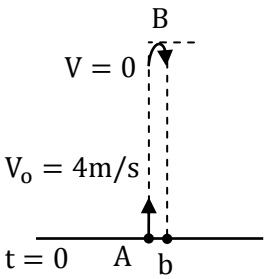
15. A point mass is shooted vertically upward with a gun and initial velocity 4 m/sat t = 0. It comes back to ground and rebound but 20% of the velocity is lost in rebounding. If the final velocity comes to zero then how much time it will take?

(A) 1 (B) 2

(C) 4 (D) ∞

[Ans. C]

Let time taken by object to reach B = t



Total time taken to reach at back to 'A'

$T = 2t = \frac{2V_o}{g}$

After 1st rebound velocity will be,

$V_1 = V_o - 20\%\ V_o$

$= V_o - \frac{20}{100}V_o$

$V_1 = 0.8\ V$

Time taken to come back $T_1 = \frac{2 \cdot V_1}{g}$

Total time and so on

$T = \frac{2\ V_o}{g} + \frac{2\ V_1}{g} + \frac{2\ V_2}{g} + \cdots\cdots\cdots$

$T = \frac{2}{g} \cdot V_o \cdot \left[1 + \frac{V_1}{V_o} + \frac{V_2}{V_o} + \frac{V_3}{V_o} + \cdots\cdots\cdots\right]$

$T = \frac{2}{g} \cdot V_o \left[1 + \frac{0.8\ V_o}{V_o} + \frac{(0.8)^2\ v_o}{V_o} + \frac{(0.8)^3 V_o}{V_o} + \cdots\cdots\cdots\right]$

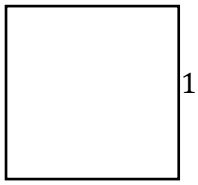
$T = \frac{2}{10} \times 4 \left[\underbrace{1 + 0.8 + (0.8)^2 + (0.8)^3 + \cdots\cdots\cdots}_{\text{Geometric progression series up to } \infty}\right]$

$T = 0.8 \times \frac{1}{[1 - 0.8]} = \frac{0.8}{0.2} = 4$

$t = 4\ sec$

16. A steel column of rectangular cross-section is simply supported at ends. Length of the column is 1.5 m and cross section dimensions are 15 mm × 10 mm. Modulus of elasticity is 200 GPa. The critical load (in kN) which the column can carry is_____kN.

[Ans. *]Range: 1.09 to 1.09



$I_{min} = \frac{15 \times 10^3}{12}$ mm^4

E = 200 GPa = 200×10^3 MPa

Le = 1.5 m = 1.5×10^3 mm; $P_{critical} = 1.09$ kN

17. A bar is compressed up to half of its original length. The magnitude of true strain produced in cylinder is_____?

[Ans. *]Range: -0.693 to -0.693

Before compression

After compression

Engineering strain produced $E = \frac{L_f - L_i}{L_i} = \frac{\frac{L_o}{2} - L_o}{L_o}$

$\epsilon = -0.5$

True strain $\epsilon_T = \ln(1 + \epsilon) = \ln(1 - 0.5)$

$\epsilon_T = \ln(0.5)$

$\epsilon_T = -0.693$

18. A carpenter glued two different logs at interface and they are subjected to 4 MPa stress along x.

Assuming that failure will occur at interface before logs consider the two statements:

(i) Joint at interface will fail if normal stress exceeds 2.5 MPa at joint.

(ii) Joint at interface will fail if shear stress exceeds 1.5 MPa.

Which one of the following is correct?

(A) Failure will occur because of (i).

(B) Failure will occur because of (ii).

(C) Failure will occur because of both (i) and (ii).

(D) Failure will not occur.

[Ans. A]

19. If σ_1 and σ_3 are maximum and minimum values of principle stresses then the maximum value of shear stress is?

(A) $\frac{\sigma_1-\sigma_3}{2}$

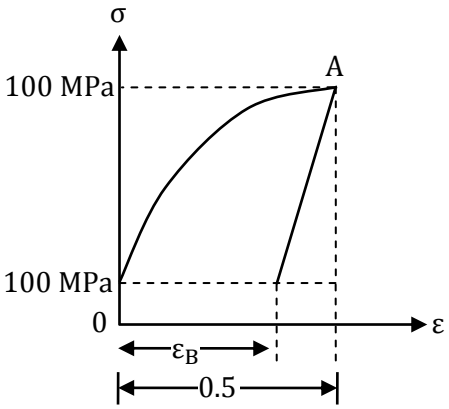
(B) $\sqrt{\frac{\sigma_1-\sigma_3}{2}}$

(C) $\left(\frac{\sigma_1+\sigma_3}{2}\right)$

(D) $\sqrt{\frac{\sigma_1+\sigma_3}{2}}$

[Ans. B]

20. True stress$_{(\sigma)}$V$_s$ true strain ε curve is shown in figure when material is loaded up to A. At A stress is 500 MPa and strain is 0.5. When material is unloaded up to B, what will be the strain at B if stress at B is 100 MPa?

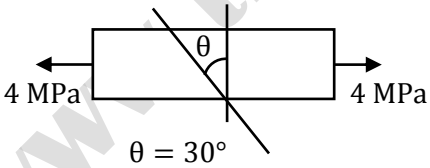


[Ans. *]Range: 0.498 to 0.498

21. A column having a rectangular section of width 15 mm and height = 10 mm is simply supported its having length of 1.5 mm. Calculate critical buckling load (N).

[Ans. *] Range: 1.1 to 1.1

22. Two wooden pieces are attached as shown in figure below. Their attached with figure so the angle (θ) is given in the diagram is 30° and the whole assembly experience 10 in tensile stress of 4 MPa.



1. Maximum tensile stress glue can take 2.5 MPa
2. Shear stress glue can taken 1.5 MPa

Assume that failure will be happen in Clue not in wood?

(A) It fails by to tensile stress not shear stress

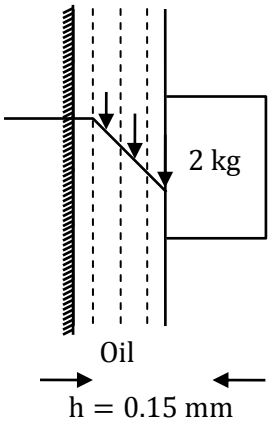
(B) It fails by shear stress not tensile?

(C) Fails by both of them

(D) Fail by none of them

[Ans. C]

23. A block of mass 2 kg slides down steadily against a vertical wall. A very thin layer of oil acts as a lubricant between the block and the wall.



If interface area of block is 0.04 m^2, it's dynamic viscosity is 7×10^{-3} pa-sec. Find out the terminal velocity of the block.
Assume the velocity profile develop in oil layer due to sliding of block to be linear.
[Ans. *]Range:

24. An eng9ine operates on Otto cycle with initial supply of air at 0.1 MPa and 15°C.
The compression ratio of cycle is 8 and heat supplied is 500 kJ/kg.
What is the maximum temperature for the cycle?
[Ans. *]Range:

MORE QUESTIONS COMING SOON