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**GATE**

**Previous Year Questions**

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# Introduction

This book contains a typed GATE question set.



# Chapter 1

## 2007

### ME

1.1 In a machine shop, pins of 15 mm 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 production is 1000. If backlog is not allowed, the maximum inventory level is

- (a) 400
- (b) 500
- (c) 600
- (d) 700

1.2 The net requirements of an item over 5 consecutive weeks are 50-0-15-20-20. The inventory carrying cost and ordering cost are Rs. 1 per item per week and Rs. 100 per order respectively. Starting inventory is zero. Use “Least Unit Cost Technique” for developing the plan. The cost of the plan (in Rs.) is

- (a) 200
- (b) 250



(c) 255

(d) 260

### **Common Data Questions**

#### **1.0.1. Common Data for Questions 71, 72, 73:**

A gear set has a pinion with 20 teeth and a gear with 40 teeth. The pinion runs at 30 rev/s and transmits a power of 20 kW. The teeth are on the  $20^\circ$  full-depth system and have a module of 5 mm. The length of the line of action is 19 mm.

1.3 The center distance for the above gear set in mm is

(a) 140

(b) 150

(c) 160

(d) 170

1.4 The contact ratio of the contacting tooth is

(a) 1.21

(b) 1.25

(c) 1.29

(d) 1.33

1.5 The resultant force on the contacting gear tooth in N is

(a) 77.23

(b) 212.20

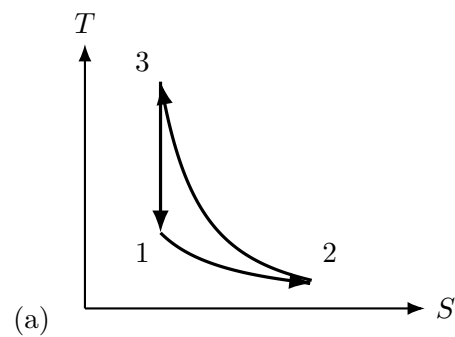
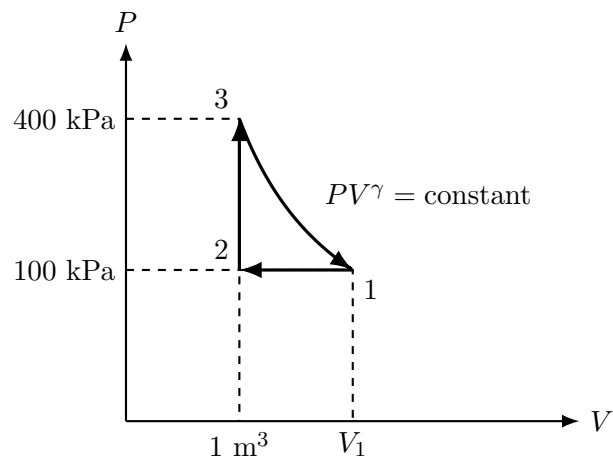
(c) 225.80

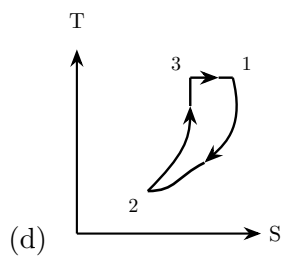
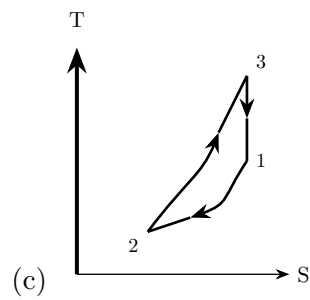
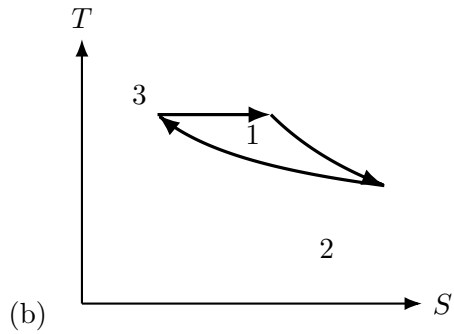
(d) 289.43

### 1.0.2. Common Data for Questions 74, 75:

A thermodynamic cycle with an ideal gas as working fluid is shown below.

1.6 The above cycle is represented on T-S plane by:





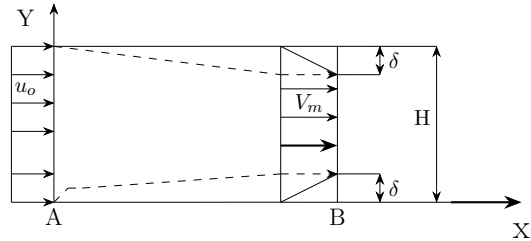
1.7 If the specific heats of the working fluid are constant and the value of specific heat ratio  $\gamma$  is 1.4, the thermal efficiency (%) of the cycle is

- (a) 21
- (b) 40.9
- (c) 42.6
- (d) 59.7

**Linked Answer Questions: Q.76 to Q.85**

### 1.0.3. Statement for Linked Answer Questions 76 & 77:

Consider a steady incompressible flow through a channel as shown below.



The velocity profile is uniform with a value of  $u_0$  at the inlet section A. The velocity profile at section B downstream is

$$u = \begin{cases} V_m \frac{y}{\delta} & 0 \leq y \leq \delta \\ V_m & \delta \leq y \leq H - \delta \\ V_m \frac{H-y}{\delta} & H - \delta \leq y \leq H \end{cases}$$

1.8 The ratio  $V_m/u_0$  is

(a)  $\frac{1}{1-2(\delta/H)}$

(b) 1

(c)  $\frac{1}{1-(\delta/H)}$

(d)  $\frac{1}{1+(\delta/H)}$

1.9 The ratio  $\frac{p_A - p_B}{\frac{1}{2}\rho u_0^2}$  (where  $p_A$  and  $p_B$  are the pressures at section A and B, respectively, and  $\rho$  is the density of the fluid) is

- (a)  $\frac{1}{(1-(\delta/H))^2} - 1$
- (b)  $\frac{1}{[1-(\delta/H)]^2}$
- (c)  $\frac{1}{(1-2(\delta/H))^2} - 1$
- (d)  $\frac{1}{1+(\delta/H)}$

### 1.0.4. Statement for Linked Answer Questions 78 & 79:

Consider steady one-dimensional heat flow in a plate of 20 mm thickness with a uniform heat generation of  $80 \text{ MW/m}^3$ . The left and right faces are kept at constant temperatures of  $160^\circ\text{C}$  and  $120^\circ\text{C}$  respectively. The plate has a constant thermal conductivity of  $200 \text{ W/mK}$ .

1.10 The location of maximum temperature within the plate from its left face is

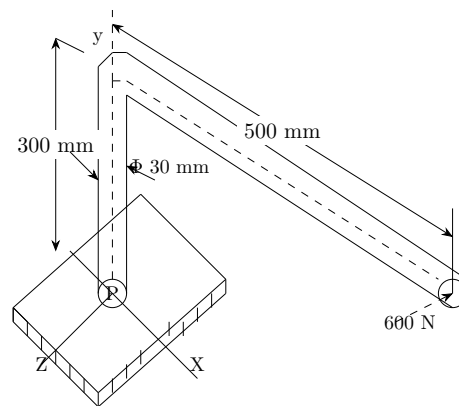
- (a) 15 mm
- (b) 10 mm
- (c) 5 mm
- (d) 0 mm

1.11 The maximum temperature within the plate in  $^\circ\text{C}$  is

- (a) 160
- (b) 165
- (c) 200
- (d) 250

### 1.0.5. Statement for Linked Answer Questions 80 & 81:

A machine frame shown in the figure below is subjected to a horizontal force of 600 N parallel to  $z$ -direction.



1.12 The normal and shear stresses in MPa at point  $P$  are respectively

- (a) 67.9 and 56.6
- (b) 56.6 and 67.9
- (c) 67.9 and 0.0
- (d) 0.0 and 56.6

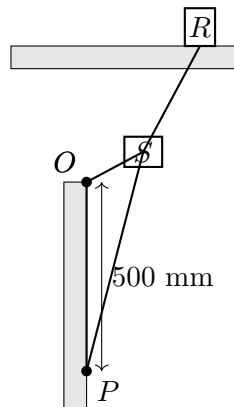
1.13 The maximum principal stress in MPa and the orientation of the corresponding principal plane in degrees are respectively

- (a)  $-32.0$  and  $-29.52$
- (b) 100.0 and 60.48
- (c)  $-32.0$  and 60.48

(d) 100.0 and  $-29.52$

### 1.0.6. Statement for Linked Answer Questions 82 & 83:

A quick return mechanism is shown below. The crank OS is driven at 2 rev/s in counter-clockwise direction.



1.14 If the quick return ratio is 1:2, then the length of the crank in mm is

- (a) 250
- (b)  $250\sqrt{3}$
- (c) 500
- (d)  $500\sqrt{3}$

1.15 The angular speed of PQ in rev/s when the block R attains maximum speed during forward stroke (stroke with slower speed) is

- (a)  $\frac{1}{3}$

(b)  $\frac{2}{3}$

(c) 2

(d) 3

### **1.0.7. Statement for Linked Answer Questions 84 & 85:**

A low carbon steel bar of 147 mm diameter with a length of 630 mm is being turned with uncoated carbide insert. The observed tool lives are 24 min and 12 min for cutting velocities of 90 m/min and 120 m/min respectively. The feed and depth of cut are 0.2 mm/rev and 2 mm respectively. Use the unmachined diameter to calculate the cutting velocity.

1.16 When tool life is 20 min, the cutting velocity in m/min is

(a) 87

(b) 97

(c) 107

(d) 114

1.17 Neglect over-travel or approach of the tool. When tool life is 20 min, the machining time in min for a single pass is

(a) 5

(b) 10

(c) 15



(d) 20

## Chapter 2

**2008**



## **Chapter 3**

**2009**



## Chapter 4

**2010**



## Chapter 5

**2011**





## Chapter 6

**2012**



**Chapter 7**

**2013**



## Chapter 8

**2014**



## Chapter 9

**2015**





## Chapter 10

**2016**



## Chapter 11

**2017**



## **Chapter 12**

**2018**



## Chapter 13

**2019**





## Chapter 14

**2020**



## Chapter 15

**2021**



## Chapter 16

**2022**



## Chapter 17

**2023**





## Chapter 18

2024

### DA

18.1 If ‘ $\rightarrow$ ’ denotes increasing order of intensity, then the meaning of the words [sick  $\rightarrow$  infirm  $\rightarrow$  moribund] is analogous to [silly  $\rightarrow$  \_\_\_\_\_  $\rightarrow$  daft].

Which one of the given options is appropriate to fill the blank?

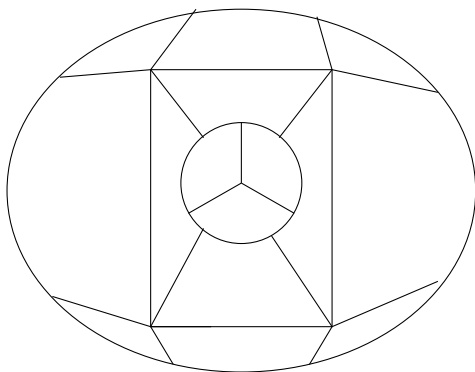
(a) frown

(b) fawn

(c) vein

(d) vain

18.2 The 15 parts of the given figure are to be painted such that no two adjacent parts with shared boundaries (excluding corners) have the same color. The minimum number of colors required is:



- (a) 4
- (b) 3
- (c) 5
- (d) 6

18.3 How many 4-digit positive integers divisible by 3 can be formed using only the digits  $\{1, 3, 4, 6, 7\}$ , such that no digit appears more than once in a number?

- (a) 24
- (b) 42
- (c) 78
- (d) 12

18.4 The sum of the following infinite series is

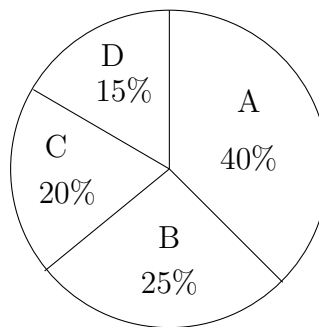
$$2 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{8} + \frac{1}{9} + \frac{1}{16} + \frac{1}{27} + \dots$$

- (a)  $\frac{11}{3}$
- (b)  $\frac{7}{2}$

(c)  $\frac{13}{4}$

(d)  $\frac{9}{2}$

- 18.5 In an election, the share of valid votes received by the four candidates A, B, C, and D is represented by the pie chart shown. The total number of votes cast in the election were 1,15,000, out of which 5,000 were invalid.



Based on the data provided, the total number of valid votes received by the candidates B and C is:

(a) 45,000

(b) 49,500

(c) 51,750

(d) 54,000

- 18.6 Thousands of years ago, some people began dairy farming. This coincided with a number of mutations in a particular gene that resulted in these people developing the ability to digest dairy milk.//

Based on the given passage, which of the following can be inferred?

(a) All human beings can digest dairy milk.

- (b) No human being can digest dairy milk.
- (c) Digestion of dairy milk is essential for human beings.
- (d) In human beings, digestion of dairy milk resulted from a mutated gene.

18.7 The probability of a boy or a girl being born is  $\frac{1}{2}$ . For a family having only three children, what is the probability of having two girls and one boy?

- (a)  $\frac{3}{8}$
- (b)  $\frac{1}{8}$
- (c)  $\frac{1}{4}$
- (d)  $\frac{1}{2}$

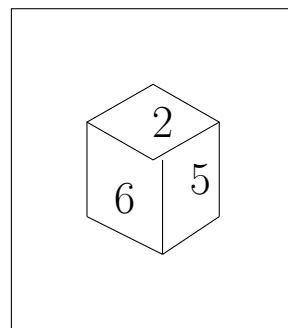
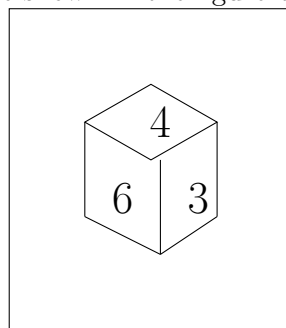
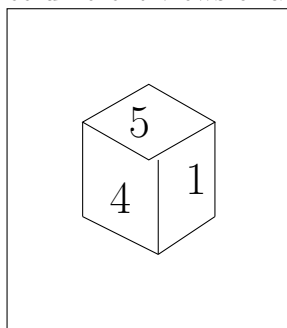
18.8 Person 1 and Person 2 invest in three mutual funds A, B, and C. The amounts they invest in each of these mutual funds are given in the table.

	Mutual fund A	Mutual fund B	Mutual fund C
<b>Person 1</b>	<i>Rs</i> 10,000	<i>Rs</i> 20,000	<i>Rs</i> 20,000
<b>Person 2</b>	<i>Rs</i> 20,000	<i>Rs</i> 15,000	<i>Rs</i> 15,000

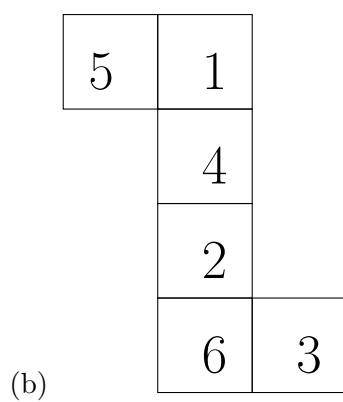
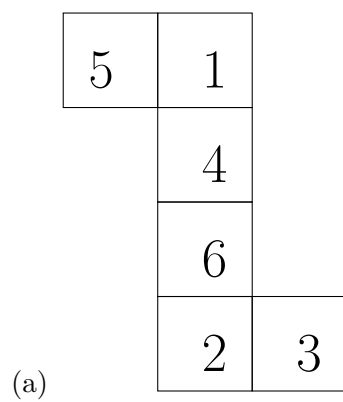
At the end of one year, the total amount that Person 1 gets is Rs 500 more than Person 2. The annual rate of return for the mutual funds B and C is 15% each. What is the annual rate of return for the mutual fund A?

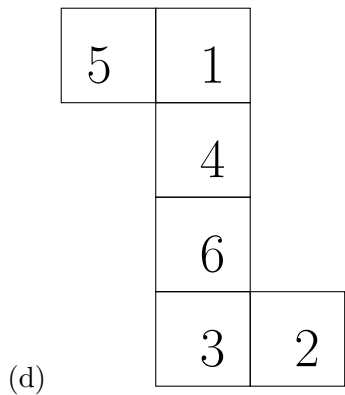
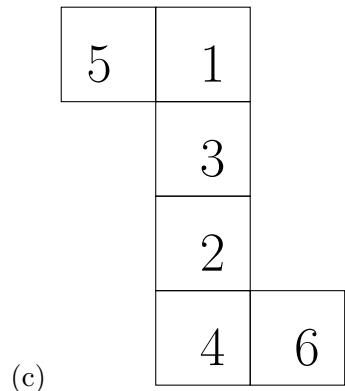
- (a) 7.5%
- (b) 10%
- (c) 15%
- (d) 20%

18.9 Three different views of a dice are shown in the figure below.



The piece of paper that can be folded to make this dice is





18.10 Visualize two identical right circular cones such that one is inverted over the other and they share a common circular base. If a cutting plane passes through the vertices of the assembled cones, what shape does the outer boundary of the resulting cross-section make?

- (a) A rhombus
- (b) A triangle
- (c) An ellipse
- (d) A hexagon

18.11 Consider the following statements:

- (i) The mean and variance of a Poisson random variable are equal.

- (ii) For a standard normal random variable, the mean is zero and the variance is one.

Which ONE of the following options is correct?

- (a) Both (i) and (ii) are true
- (b) (i) is true and (ii) is false
- (c) (ii) is true and (i) is false
- (d) Both (i) and (ii) are false

18.12 Three fair coins are tossed independently.  $T$  is the event that two or more tosses result in heads.  $S$  is the event that two or more tosses result in tails. What is the probability of the event  $T \cap S$ ?

- (a) 0
- (b) 0.5
- (c) 0.25
- (d) 1

18.13 Consider the matrix  $\mathbf{M} = \begin{pmatrix} 2 & -1 \\ 3 & 1 \end{pmatrix}$

Which ONE of the following statements is TRUE?

- (a) The eigenvalues of  $\mathbf{M}$  are non-negative and real.
- (b) The eigenvalues of  $\mathbf{M}$  are complex conjugate pairs.
- (c) One eigenvalue of  $\mathbf{M}$  is positive and real, and another eigenvalue of  $\mathbf{M}$  is zero.
- (d) One eigenvalue of  $\mathbf{M}$  is non-negative and real, and another eigenvalue of  $\mathbf{M}$  is negative and real.



