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<b>R-20</b>
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**Code: 20A322T**

I B.Tech. II Semester Regular & Supplementary Examinations July 2023

**Engineering Graphics & Design**  
(Mechanical Engineering)

Max. Marks: 70

Time: 3 Hours

Answer *five full* questions by choosing one question from each unit (5 x 14 = 70 Marks)

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Marks CO BL

**UNIT-I**

1. a) A hexagonal pyramid of base side 30 mm and height 60 mm is resting on HP on one of its base corners such that the axis is inclined at 45° to HP and parallel to VP. Draw its projections. 7M CO1 L3
- b) Draw projections of a right circular cylinder of base 45 mm diameter and 60 mm long when it lies on HP such that its axis is inclined at 30° to HP. 7M CO1 L3

**OR**

2. A square prism side of base 30 mm and axis 50 mm long has its axis inclined at 60° to HP. It has an edge of its base in the HP and inclined at 45° to the VP. Draw its projections. 14M CO1 L3

**UNIT-II**

3. A hexagonal prism, side of base 30 mm and axis 60 mm long, lies with one of its rectangular faces on HP, and its axis inclined at 30° to the VP. A section plane perpendicular to HP and parallel to VP cuts the prism into two halves. Obtain its top and sectional front views. 14M CO2 L3

**OR**

4. A square pyramid of side of base 25 mm and height 60 mm rests on the base with a base edge 45° inclined to VP. It is cut by a plane perpendicular to the VP and inclined at 45° to the HP meeting the axis at 25 mm from the vertex. Draw the plan, elevation and true shape of the section. 14M CO2 L3

**UNIT-III**

5. A pentagonal pyramid side of base 30 mm and height 52 mm stands with this base of HP and an edge of base is parallel to VP and nearer to it. It is cut by a plane perpendicular to VP inclined at 40° to HP and passing through a point on the axis 32 mm above the base. Draw the sectional top view and develop the lateral surface of the truncated pyramid. 14M CO3 L4

**OR**

6. A cylinder of 60 mm diameter and axis 80 mm long stands with its base on HP. It is completely penetrated by a horizontal cylinder of 40 mm diameter and axis 80 mm long such that their axes bisect each other at right angles. The axis of the penetrating cylinder is parallel to VP. Draw the projections showing curves of intersection. 14M CO3 L4

**UNIT-IV**

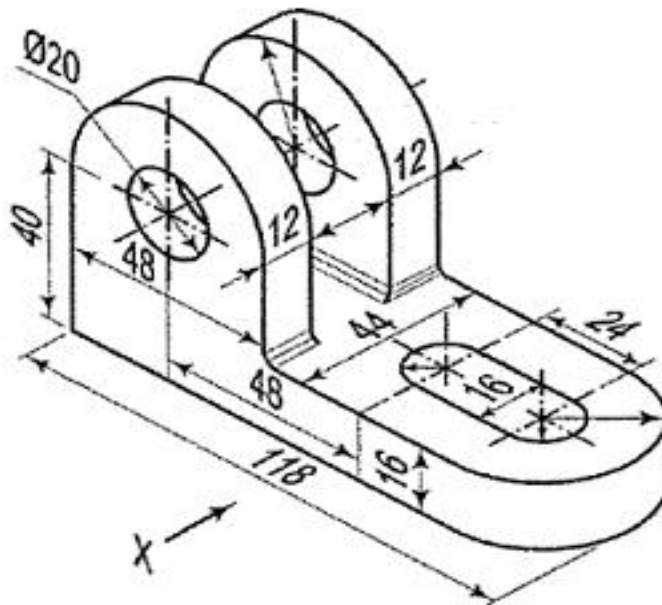
7. a) Draw an isometric view of frustum of a cone with a 60 mm base diameter, 40 mm top diameter and 70 mm long axis, resting on its base on the HP. 7M CO4 L4
- b) Draw isometric view of a hexagonal prism having a base with 30 mm side and a 70 mm long axis resting on its base on the HP with an edge of the base parallel to the VP. 7M CO4 L4

**OR**

8. A sphere of radius 20 mm is kept on the top face of a square prism of side of base 40 mm and height 20 mm. The latter is placed on the top face of a cylinder of 65 mm diameter and 25 mm height. All the three solids have the common axis. Draw the isometric projection of the combination of solids. 14M CO4 L4

**UNIT-V**

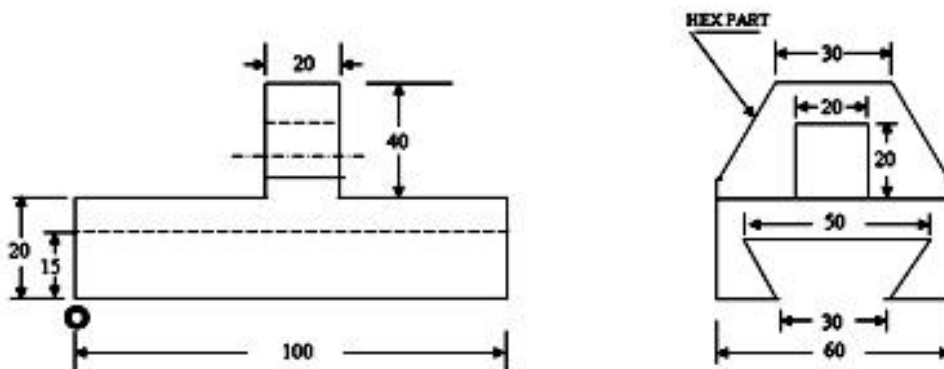
9. Draw the front view, top view and side view for the following figure.



14M CO5 L4

**OR**

10. Draw the isometric view of the following figure.



14M CO5 L4

\*\*\* End \*\*\*

**Code: 20A323T**

I B.Tech. II Semester Regular & Supplementary Examinations July 2023

**Engineering Mechanics**  
(Common to CE and ME )

Max. Marks: 70

Time: 3 Hours

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- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)  
 2. In Part-A, each question carries **Two marks**.  
 3. Answer **ALL** the questions in **Part-A** and **Part-B**

**PART-A**

(Compulsory question)

- |   |    |    |  |
|---|----|----|--|
| <b>1. Answer ALL the following short answer questions</b> ( 5 X 2 = 10M ) | CO | BL |  |
| a) State the Parallelogram law of forces.                                 | 1  | 2  |  |
| b) Define the terms angle of friction and angle of repose.                | 2  | 1  |  |
| c) Distinguish between Centroid and Centre of gravity.                    | 3  | 4  |  |
| d) Define the terms Angular velocity and Angular acceleration             | 4  | 1  |  |
| e) State the principle of conservation of energy.                         | 5  | 2  |  |

**PART-B**

Answer *five* questions by choosing one question from each unit ( 5 x 12 = 60 Marks )

Marks    CO    BL

**UNIT-I**

- |  |    |   |   |
|--|----|---|---|
| 2. a) Classify the system of forces with neat sketches                                 | 5M | 1 | 2 |
| b) Determine the resultant of four forces concurrent at the origin as shown in Fig. 1. |    |   |   |

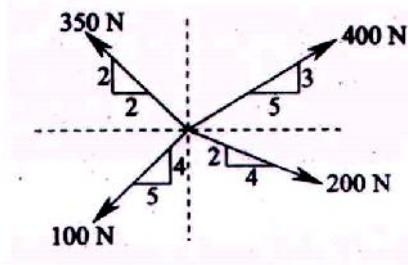


Fig.1

7M    1    3

**OR**

- |  |    |   |   |
|--|----|---|---|
| 3. a) State and prove Varignon's theorem.  | 5M | 1 | 2 |
| b) Two smooth spheres P,Q each of radius 25 cm and weighing 500N, rest in a horizontal channel having vertical walls as shown in Fig.2. If the distance between the walls is 90cm. Calculate the reactions at points of contact A,B and C. |    |   |   |

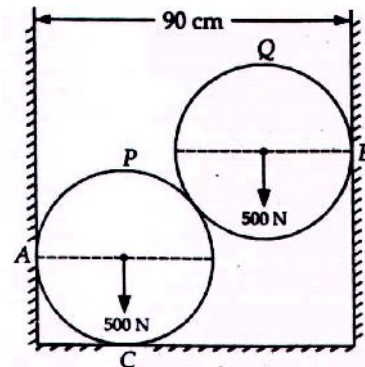


Fig.2

7M    1    3

## UNIT-II

4. A truss of span 10 metres is loaded as shown in Fig.3. Find the reactions and forces in the members of the truss.

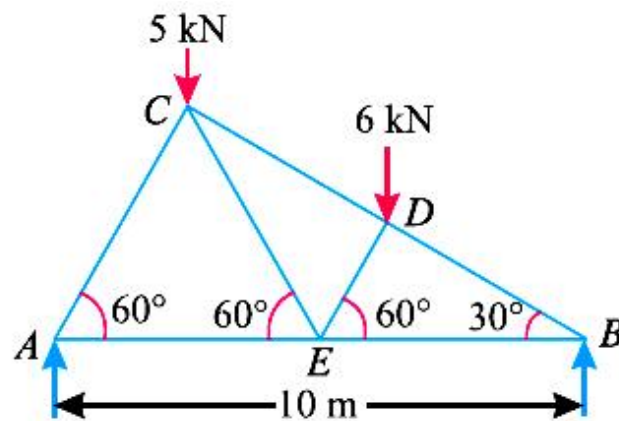


Fig.3

12M 2 3

OR

5. a) Explain briefly about Wedge friction  
 b) Two identical blocks A and B are connected by a rod and rest respectively against vertical wall and horizontal floor as shown in Fig.4. The sliding motion of the block impends when rod makes an angle of  $45^\circ$  with the horizontal. Calculate the coefficient of friction assuming it to be same both at the floor and wall.

4M 2 2

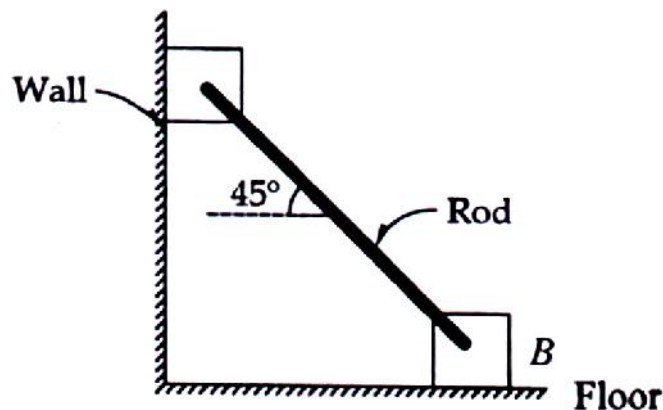


Fig.4

8M 2 3

## UNIT-III

6. Find the Centroid of the shaded area bounded by a straight line and a parabola as shown in Fig.5.

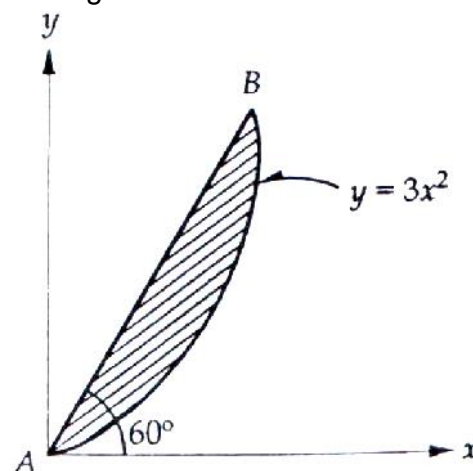


Fig.5

12M 3 3

OR

7. Find the moments of inertia of the I-Section shown in Fig.6 about the centroidal axes.

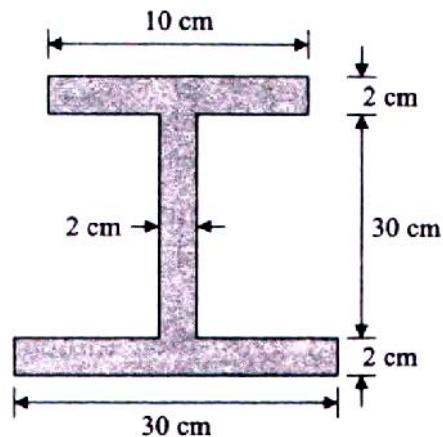


Fig.6

12M 3 3

UNIT-IV
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8. A particle moves along a straight line so that its displacement in metre from a fixed point is given by,  $S = 2t^3 + 4t^2 - 6t + 8$ . Determine: (i) velocity at start, (ii) velocity after 5 seconds, (iii) acceleration at start and (iv) acceleration after 5 seconds.

12M 4 3

OR

9. a) A wheel, rotating about a fixed axis at 20 rpm, is uniformly accelerated for 70 seconds, during which time it makes 50 revolutions. Determine: (i) Angular velocity at the end of this interval, and (ii) time required for the speed to reach 100 revolutions per minute.
- b) Explain briefly about Plane motion.

8M 4 4

4M 4 2

UNIT-V
--------

10. A train of weight 2000 kN moves down a slope of 1 in 150 at 18 km/hr and engine develops a power of 35 kW. If the train is pulled up at the same speed, Calculate power required to pull the train.

12M 5 3

OR

11. Two blocks weighing 100 N and 40 N are supported at the ends of a rope of negligible weight which is passing over the rough surface of a pulley mounted on a horizontal axle. The pulley may be assumed as a solid disc with a weight of 50N. Friction in bearings of the pulley may be neglected. Find the tension on the two parts of the two ropes and the linear acceleration of the blocks.

12M 5 3

\*\*\* End \*\*\*

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<b>R-20</b>
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**Code: 20A321T**

I B.Tech. II Semester Regular & Supplementary Examinations July 2023

## Engineering Materials

(Mechanical Engineering)

Max. Marks: 70

Time: 3 Hours

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- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)  
 2. In Part-A, each question carries **Two marks**.  
 3. Answer **ALL** the questions in **Part-A** and **Part-B**

### PART-A

(Compulsory question)

- |   |     |    |
|---|-----|----|
| <b>1. Answer ALL the following short answer questions ( 5 X 2 = 10M )</b> | CO  | BL |
| a) Define alloy.  | CO1 | L1 |
| b) Define two component eutectic system.                                  | CO2 | L1 |
| c) Give classification of castirons.                                      | CO3 | L1 |
| d) Differentiate hardenability and hardness.                              | CO4 | L2 |
| e) List the properties of cermets.  | CO5 | L1 |

### PART-B

Answer *five* questions by choosing one question from each unit ( 5 x 12 = 60 Marks )

Marks    CO    BL

#### UNIT-I

- |   |    |   |    |
|---|----|---|----|
| 2. a) Write about crystal, space lattice and unit cell.   | 6M | 1 | L1 |
| b) Draw B.C.C and F.C.C structures and calculate the atomic packing factor for B.C.C, F.C.C structures. | 6M | 1 | L2 |

**OR**

- |   |    |   |    |
|---|----|---|----|
| 3. a) Define solid solution and explain the types of solid solutions. | 6M | 1 | L1 |
| b) Write about Hume Rotherys rules with examples.                     | 6M | 1 | L2 |

#### UNIT-II

- |   |    |   |    |
|---|----|---|----|
| 4. a) Explain phase rule and lever rule.            | 6M | 2 | L1 |
| b) Write short notes on Peritectics and Eutectoits. | 6M | 2 | L1 |

**OR**

- |  |     |   |    |
|--|-----|---|----|
| 5. a) Sketch neatly the ideal iron-carbide binary equilibrium diagram, indicating temperature, composition and different phases present. | 12M | 2 | L2 |
|--|-----|---|----|

#### UNIT-III

- |   |     |   |    |
|---|-----|---|----|
| 6. a) Classify steels on carbon content and discuss on the properties and application of various types of steels. | 12M | 3 | L1 |
|---|-----|---|----|

**OR**

7. a) Explain the composition, structure, properties and applications of any two cast irons. 6M 3 L1
- b) Explain the structure and properties of copper and its alloys. 6M 3 L1

**UNIT-IV**

8. a) Discuss the effect of alloying elements on Fe-Fe<sub>3</sub>C phase diagram. 6M 4 L2
- b) What are the different heat treatment processes? Explain any two. 6M 4 L1

**OR**

9. Explain TTT diagram in detail with an example. 12M 4 L2

**UNIT-V**

10. Discuss the properties and applications of the following ceramics (a) Silica (b) Zirconia (c) SiC (d) Cubic boron nitride 12M 5 L1

**OR**

11. a) List the advantages and application of composites. 6M 5 L1
- b) How composites are manufactured? Explain any one method in detail. 6M 5 L2

\*\*\* End \*\*\*

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<b>R-20</b>
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**Code: 20AC24T**

I B.Tech. II Semester Regular & Supplementary Examinations July 2023

**Engineering Physics**  
(Common to CE & ME )

Max. Marks: 70

Time: 3 Hours

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- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)  
2. In Part-A, each question carries **Two marks**.  
3. Answer **ALL** the questions in **Part-A** and **Part-B**

**PART-A**

(Compulsory question)

- |  |                 |     |    |
|--|-----------------|-----|----|
| 1. Answer ALL the following short answer questions | ( 5 X 2 = 10M ) | CO  | BL |
| a) What is center of mass?                         |                 | CO1 | L2 |
| b) What are Ultrasonics?                           |                 | CO2 | L1 |
| c) Write any two applications of Dielectrics.      |                 | CO3 | L3 |
| d) What is Population Inversion?                   |                 | CO4 | L2 |
| e) What is the use of a Pyro electric detector?    |                 | CO5 | L3 |

**PART-B**

Answer *five* questions by choosing one question from each unit ( 5 x 12 = 60 Marks )

- |   | Marks | CO  | BL |
|---|-------|-----|----|
| <b>UNIT-I</b>   |       |     |    |
| 2. a) Explain conservative force and prove that conservative force is divergence of potential energy. | 10M   | CO1 | L2 |
| b) Define torque.   | 2M    | CO1 | L1 |
| <b>OR</b>   |       |     |    |
| 3. Explain the non-inertial frame of reference with constant angular velocity.                        | 12M   | CO1 | L2 |
| <b>UNIT-II</b>  |       |     |    |
| 4. Derive Sabine's law by growth and decay method.  | 12M   | CO2 | L3 |
| <b>OR</b>   |       |     |    |
| 5. a) Explain the production of Ultrasonics by Piezo electric method.                                 | 6M    | CO2 | L2 |
| b) Write a note on Non Destructive Testing.   | 6M    | CO2 | L3 |
| <b>UNIT-III</b>   |       |     |    |
| 6. a) Derive Clausius-Mossotti equation.  | 8M    | CO3 | L3 |
| b) Define ionic polarizability and write its equation   | 4M    | CO3 | L1 |



**OR**

7. a) Classify the different types of Magnetic materials and mention any three properties. 9M CO3 L2  
 b) Explain the Hysteresis loop. 3M CO3 L2

**UNIT-IV**

8. a) List the applications of laser. 4M CO4 L2  
 b) Describe the Construction and Working of He-Ne gas Laser. 8M CO4 L2

**OR**

9. a) Explain the construction of optical fibre. 4M CO4 L1  
 b) Classify the types of Optical Fibres. 8M CO4 L2

**UNIT-V**

10. Explain Piezo electric and magneto strictive sensors. 12M CO5 L2

**OR**

11. a) What is a sensor? Explain. 4M CO5 L2  
 b) Explain the working of thermal sensors. 8M CO5 L2

\*\*\* End \*\*\*

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**R-20**

**Code: 20AC21T**

I B.Tech. II Semester Regular & Supplementary Examinations July 2023

**Differential Equations and Vector Calculus**

(Common to all Branches)

Max. Marks: 70

Time: 3 Hours

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- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)  
 2. In Part-A, each question carries **Two marks**.  
 3. Answer **ALL** the questions in **Part-A** and **Part-B**

**PART-A**

(Compulsory question)

- |  |                 |    |    |
|--|-----------------|----|----|
| 1. Answer ALL the following short answer questions ( 5 X 2 = 10M ) |                 | CO | BL |
| a) Find the particular integral of $(D^2 - 2D + 1)y = e^{2x}$      | ( 5 X 2 = 10M ) | 1  | 2  |
| b) Write the second order Legendre's Linear Equation form          |                 | 2  | 3  |
| c) Find the partial differential equations of $Z=ax+by$            |                 | 3  | 2  |
| d) Find div F if $F = (x^3 + y^3 + z^3 - xyz)$                     |                 | 4  | 3  |
| e) State Stoke's Thorem  |                 | 5  | 3  |

**PART-B**

Answer five questions by choosing one question from each unit ( 5 x 12 = 60 Marks)

Marks CO BL

- |  |     |   |   |
|--|-----|---|---|
|  |     |   |   |
| <b>UNIT-I</b>  |     |   |   |
| 2. Solve $(D - 2)^2 y = e^{2x} + \sin 2x + x^2$  | 12M | 1 | 3 |
| <b>OR</b>  |     |   |   |
| 3. Using variation of parameter to solve $\frac{d^2 y}{dx^2} + a^2 y = \sec ax$  | 12M | 1 | 3 |
| <b>UNIT-II</b>   |     |   |   |
| 4. Solve $(1 + x^2) \frac{d^2 y}{dx^2} + (1 + x^2) \frac{dy}{dx} + y = \sin [\log(1 + x^2)]$   | 12M | 2 | 3 |
| <b>OR</b>  |     |   |   |
| 5. An uncharged condenser of capacity C is charged by applying an e. m.f $\frac{E \sin t}{\sqrt{LC}}$ through leads of self-inductance L and negligible resistance, prove that at any time t, the charge on one of the plates is $\frac{EC}{2} \left\{ \sin \frac{t}{\sqrt{LC}} - \frac{t}{\sqrt{LC}} \cos \frac{t}{\sqrt{LC}} \right\}$ | 12M | 2 | 3 |
| <b>UNIT-III</b>  |     |   |   |
| 6. a) Form the partial differential equation by eliminating arbitrary functions f and g from $z = f(x + at) + g(x - at)$   | 6M  | 3 | 3 |
| b) Solve $x^2(y - z)p + y^2(z - x)q = z^2(x - y)$  | 6M  | 3 | 3 |

OR

7. Using the method of separation of variables, solve  $\frac{\partial u}{\partial x} = 2 \frac{\partial u}{\partial t} + u$  where  $u(x, 0) = 6e^{-3x}$  12M 3 3

UNIT-IV

8. a) Find the directional derivative of  $f(x, y, z) = xy^2 + yz^3$  at the point  $(2, -1, 1)$  in the direction of vector  $\vec{i} + \vec{j} + \vec{k}$ . 6M 4 3
- b) Find the angle between the surfaces  $z = x^2 + y^2 - 3$  at the point  $(2, -1, 2)$ . 6M 4 3

OR

9. Find constants  $a, b, c$  so that the vector  $A = (x + 2y + az)\vec{i} + (bx - 3y - z)\vec{j} + (cy + 2z)\vec{k}$  is irrotational. Also find  $\phi$  such that  $A = \nabla\phi$ . 12M 4 3

UNIT-V

10. Verify Green's theorem for  $\int_C [(x^2y + y^2)dx + (x + x^2)dy]$  where  $C$  is bounded by  $y=x$  and  $y = x^2$ . 12M 5 3

OR

11. Verify Stoke's theorem for  $F = (x^2 + y^2)\vec{i} - xyz\vec{j}$  taken around the rectangle bounded by the lines  $x = \pm a, y = c, y = b$ . 12M 5 3

\*\*\* End \*\*\*