

Name:	 <b>UPES</b> UNIVERSITY WITH A PURPOSE
Enrolment No:	

**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**  
**End Semester Examination, Dec 2021, Jan 2022**

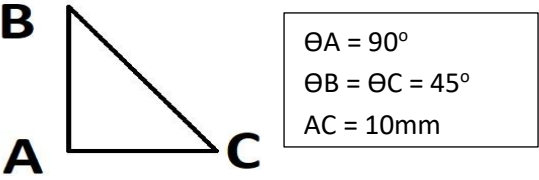
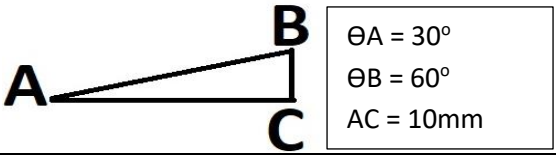
**Course: Grid Generation Techniques**  
**Program: M.Tech CFD**  
**Course Code: ASEG 7023**

**Semester: I**  
**Time 03 hrs.**  
**Max. Marks: 100**

**SECTION A**

S. No.		Marks	CO
<b>Q 1</b>	Discuss the process of transformation of grid from physical plane to computational plane.	<b>4</b>	<b>CO1</b>
<b>Q 2</b>	Discretize second order wave equation.	<b>4</b>	<b>CO1</b>
<b>Q 3</b>	Explain the significance of sizing function.	<b>4</b>	<b>CO2</b>
<b>Q 4</b>	Explain the steps involved in cubic spline method of structured grid generation	<b>4</b>	<b>CO3</b>
<b>Q 5</b>	Summarize the concept of domain triangulation.	<b>4</b>	<b>CO4</b>

**SECTION B**

<b>Q 6</b>	Transform the following terms from physical plane (x,y) to computational plane (ε,η) <ul style="list-style-type: none"> <li>i. <math>\frac{\partial}{\partial x}</math></li> <li>ii. <math>\frac{\partial^2}{\partial x^2}</math></li> <li>iii. <math>\frac{\partial}{\partial x \partial y}</math></li> </ul>	<b>10</b>	<b>CO1</b>
<b>Q 7</b>	Find out the quality parameter of the following elements: <div style="display: flex; flex-direction: column; align-items: flex-start; margin-top: 10px;"> <div style="display: flex; align-items: center; margin-bottom: 20px;">  <div style="border: 1px solid black; padding: 5px; margin-left: 10px;"> <math>\Theta A = 90^\circ</math>  <math>\Theta B = \Theta C = 45^\circ</math>  <math>AC = 10\text{mm}</math> </div> </div> <div style="display: flex; align-items: center;">  <div style="border: 1px solid black; padding: 5px; margin-left: 10px;"> <math>\Theta A = 30^\circ</math>  <math>\Theta B = 60^\circ</math>  <math>AC = 10\text{mm}</math> </div> </div> </div>	<b>10</b>	<b>CO2</b>
<b>Q 8</b>	Explain the following grid generation techniques: <ul style="list-style-type: none"> <li>i. Quadtree method</li> <li>ii. Paving method</li> </ul> <p style="text-align: center;"><b>OR</b></p> Explain the following grid generation techniques: <ul style="list-style-type: none"> <li>i. Mapping</li> <li>ii. Sweeping</li> </ul>	<b>10</b>	<b>CO2</b>

<b>Q 9</b>	Compare elliptical and hyperbolic grid generation methods.	<b>10</b>	<b>CO3</b>																
<b>SECTION-C</b>																			
<b>Q 10</b>	<p>Discuss in detail about the Lagrange polynomial mapping method for generation of structured grid. Apply this method to map physical axis to computational axis for the following nodal data:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Nodal Coordinates on physical axis</th> <th style="text-align: center;">Corresponding coordinates on computational axis</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">5</td> <td style="text-align: center;">2</td> </tr> <tr> <td style="text-align: center;">12</td> <td style="text-align: center;">3</td> </tr> </tbody> </table> <p style="text-align: center;"><b>OR</b></p> <p>Explain how physical stretched structured grid can be mapped to computational equidistance grid using Hermite polynomial method? Map the following coordinates by applying Hermite polynomial method:</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Nodal Coordinates on physical axis</th> <th style="text-align: center;">Corresponding coordinates on computational axis</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">9</td> <td style="text-align: center;">3</td> </tr> <tr> <td style="text-align: center;">16</td> <td style="text-align: center;">3</td> </tr> </tbody> </table>	Nodal Coordinates on physical axis	Corresponding coordinates on computational axis	2	1	5	2	12	3	Nodal Coordinates on physical axis	Corresponding coordinates on computational axis	1	1	9	3	16	3	<b>20</b>	<b>CO3</b>
Nodal Coordinates on physical axis	Corresponding coordinates on computational axis																		
2	1																		
5	2																		
12	3																		
Nodal Coordinates on physical axis	Corresponding coordinates on computational axis																		
1	1																		
9	3																		
16	3																		
<b>Q 11</b>	Formulate the process of advancing front method for the generation of unstructured grid and hence explain various steps involved in the process with the help of a diagram.	<b>20</b>	<b>CO4</b>																