



SNS COLLEGE OF TECHNOLOGY
(An Autonomous Institution)
DEPARTMENT OF AERONAUTICAL ENGINEERING



One Mark Questions with Answers

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Subject Code & Name: **16AE406 - Computational Fluid Dynamics for Aeronautical Application**

ONE MARKS QUESTION WITH ANSWER

1. CFD is method to calculate heat transfer and fluid flow

- A. numerically
- B. experimentally
- C. instantaneously
- D. None of these

2. At diastolic pressure, blood flow is

- A. turbulent
- B. mixed
- C. laminar
- D. irregular

3. Reynolds number and velocity are

- A. directly proportional to each other
- B. inversely proportional to each other
- C. equal to each other
- D. None of these

4. In steady flow of a fluid, acceleration of any fluid particle is

- A. constant
- B. zero
- C. variable
- D. non zero

5. Discretization technique is

- A. Finite volume
- B. Finite difference
- C. Finite element

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D. All of these

6. Flow in which each particle of fluid follows a smooth path is called

- A. laminar flow
- B. turbulent flow
- C. mixed flow
- D. None of these

7. When mach number < 0.8 , flow is in

- A. subsonic regime
- B. super sonic regime
- C. sonic regime
- D. hypersonic regime

8. Formula of backward differencing is

- A. $\Delta hf(x) = f(x+h) - f(x)$
- B. $2\Delta hf(x) = f(x+h) - f(x-h)$
- C. $\Delta hf(x) = f(x) - f(x+h)$
- D. $\Delta hf(x) = f(x+h) + f(x-h)$

9. Formula of central differencing is

- A. $\Delta hf(x) = f(x+h) - f(x)$
- B. $2\Delta hf(x) = f(x+h) - f(x-h)$
- C. $\Delta hf(x) = f(x) - f(x+h)$
- D. $\Delta hf(x) = f(x+h) + f(x-h)$

10. Test used to check accuracy of solution is called

- A. grid independence test
- B. solution test
- C. optimal test
- D. aspect test

11. Meshing is

- A. Localization process
- B. Merging process
- C. Discretization process
- D. None of these

12. CFD is based on fundamental governing equations of

- A. continuity
- B. energy
- C. momentum
- D. All of these

13. Forces which act directly on surface of fluid element called

- A. fluid forces
- B. body forces
- C. direct forces
- D. fluid forces

14. If μ is viscous force, ρ is density and v is velocity then Reynolds number is equal to

- A. $\rho v L / \mu$
- B. $\rho v / \mu$
- C. $\rho v L / 2 \mu$
- D. $2 \rho v L / \mu$

15. When mach number $Ma = 1$, flow is in

- A. subsonic regime
- B. super sonic regime
- C. sonic regime
- D. hypersonic regime

16. A process in which flow in boundary layer can no longer stay attached to surface & separates from surface is called

- A. Force separation
- B. boundary separation
- C. flow separation
- D. surface separation

17. For highly refined mesh, computational time required is

- A. low
- B. high
- C. near to zero
- D. None of these

18. Deviation of vector d that connects two cells from face center called

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- A. mesh orthogonality
- B. mesh skewness**
- C. mesh aspect ratio
- D. smoothness

19. difference between mathematical model and real world it is trying to represent is called

- A. modeling error**
- B. discretization error
- C. convergence error
- D. None of these

20. Finite difference method is

- A. exact solution method
- B. approximate solution method**
- C. unique solution method
- D. None of these

21. Boundary condition which include direct boundary value is

- A. Dirichlet boundary condition**
- B. Neumann boundary condition
- C. forced boundary condition
- D. discrete boundary condition

22. Region of flow trailing a body where effect of that body is felt on velocity field is called

- A. flow region
- B. wake**
- C. trailing region
- D. velocity region

23. Measure of circulation of fluid is called

- A. stability
- B. vorticity**
- C. viscosity
- D. None of these

24. Flow in which each particle of fluid follows an irregular path is called

- A. laminar flow
- B. turbulent flow**
- C. mixed flow
- D. None of these

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25. Truncation error becomes zero as mesh spacing tends to
- A. maximum
 - B. minimum
 - C. zero
 - D. None of these
26. Difference between exact solution to mathematical model and discretized equations used to approximate it is called
- A. modeling error
 - B. discretization error
 - C. convergence error
 - D. None of these
27. Euler number indicates relationship between
- A. pressure drop
 - B. temperature drop
 - C. velocity drop
 - D. viscosity drop
28. Meshes which only requires element size on lines and surfaces that define geometry as input.
- A. Structured mesh
 - B. unstructured mesh
 - C. Dirichlet mesh
 - D. None of these
29. When a direct computation of dependent variables can be made in terms of known quantities, computation is said to be
- A. implicit
 - B. explicit
 - C. unique
 - D. dependent
30. Ratio of momentum diffusivity and thermal diffusivity is called
- A. Reynolds number
 - B. Mach number
 - C. Prandtl number
 - D. Péclet number
31. Ratio between longest side and shortest side of mesh is called

- A. mesh orthogonality
- B. mesh skewness
- C. mesh aspect ratio
- D. mesh smoothness

32. When Reynolds number $Re > 4000$, flow is

- A. turbulent
- B. transient
- C. laminar
- D. None of these

33. Path of fluid particles can not be tracked in

- A. turbulent flow
- B. laminar flow
- C. mixed flow
- D. None of these

34. Artificial node is added for

- A. Dirichlet boundary condition
- B. Neumann boundary condition
- C. forced boundary condition
- D. discrete boundary condition

35. A space of interest where mass can cross boundary is

- A. Control volume
- B. Control surface
- C. control system
- D. control boundar

36. When fluid properties does not change with time, flow is called

- A. steady
- B. unsteady
- C. viscous
- D. non viscous

37. Mesh requires blocking as input called

- A. Structured mesh
- B. unstructured mesh
- C. Dirichlet mesh
- D. None of these

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38. Boundary of control volume is called

- A. Control volume
- B. Control surface**
- C. control system
- D. control boundary

39. Error occurred by approximating infinite sum by finite sum is called

- A. finite error
- B. infinite error
- C. truncation error**
- D. zero error

40. Fluid property, due to which, mercury does not wet glass is

- A. viscosity
- B. surface tension**
- C. adhesion
- D. cohesion

41. Flow separation results in

- A. energy loss and drag**
- B. energy gain and drag
- C. energy gain but no drag
- D. None of these

42. Convergent nozzle

- A. accelerate the subsonic flow**
- B. decelerate the subsonic flow
- C. has no effect on subsonic flow
- D. None of these

43. Triangular mesh is common in

- A. Structured mesh
- B. unstructured mesh**
- C. Dirichlet mesh
- D. None of these

44. angular deviation of vector located at face center from vector connecting two cell centers called

- A. mesh orthogonality**
- B. mesh skewness

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- C. mesh aspect ratio
- D. mesh smoothness

45. Quadrilateral mesh is most common in

- A. **Structured mesh**
- B. unstructured mesh
- C. Dirichlet mesh
- D. None of these

46. Boundary condition which include derivative of boundary value is

- A. Dirichlet boundary condition
- B. **Neumann boundary condition**
- C. forced boundary condition
- D. discrete boundary condition

49. Solution of Navier stroke equation is

- A. **flow velocity**
- B. force
- C. area
- D. None of these

50. Skewness is equal to

- A. (optimal cell size - cell size)/ cell size
- B. **(optimal cell size - cell size)/optimal cell size**
- C. (cell size - optimal cell size)/optimal cell size
- D. (optimal cell size - cell size)

51. Transition in size between contiguous cells called

- A. mesh orthogonality
- B. mesh skewness
- C. mesh aspect ratio
- D. **mesh smoothness**

52. Froude number indicates influence of

- A. **gravity**
- B. velocity
- C. pressure
- D. temperature

53. When Reynolds number $Re < 2300$, flow is

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- A. turbulent
- B. transient
- C. laminar
- D. None of these

54. A large Reynolds number is indication of

- A. laminar flow
- B. streamline flow
- C. steady flow
- D. turbulent flow

55. Fluid flow with no energy loss is

- A. viscous flow
- B. non viscous flow
- C. either viscous either non viscous
- D. None of these

56. Navier-stokes equation is useful in analysis of

- A. viscous flow
- B. non viscous flow
- C. Turbulent flow
- D. None of these

57. Fluid in which resistance to flow takes place is

- A. viscous fluid
- B. non viscous fluid
- C. either viscous either non viscous
- D. None of these

58. In turbulent flow, inertial forces

- A. are greater than viscous forces
- B. are lesser than viscous forces
- C. are equal to viscous forces
- D. None of these

59. Near wall flow is considered as

- A. laminar flow
- B. turbulent flow
- C. inviscid flow
- D. random flow

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60. When Reynolds number Re is in between 2300 and 4000, flow is

- A. turbulent
- B. transient
- C. laminar
- D. None of these

61. Fluid particles are tagged/identified and their properties are determined as they move in space. This approach is called

- A. Lagrangian approach
- B. Eulerian approach
- C. Navier approach
- D. None of these

62. Fluid properties are determined at fixed points in space as fluid flows. This approach is called

- A. Lagrangian approach
- B. Eulerian approach
- C. Navier approach
- D. None of these

63. Greater will be rate of convergence,

- A. better will be the mesh quality
- B. worst will be the mesh quality
- C. medium will be the mesh quality
- D. None of these

64. Difference between iterative solution results and exact solution to discretized equations is called

- A. modeling error
- B. discretization error
- C. convergence error
- D. None of these

65. method of approximating differential equations by a system of algebraic equations for variables at some set of discrete locations in space and time is called

- A. Localization
- B. Merging
- C. Discretization
- D. None of these

66. When Mach number < 0.3 , flow is

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- A. Incompressible
- B. Compressible
- C. Either compressible either incompressible
- D. None of these

67. division of physical domain into a finite number of discrete regions is

- A. meshing
- B. generation
- C. division
- D. merging

68 . Consider the Laplace equation describing steady state heat conduction in a two dimensional rectangular domain. If the equation is discretized using finite difference approximations with uniform grid spacing in both directions, and if the resulting equations are properly arranged and written in the form of a matrix equation, then the non-zero coefficients in the coefficient matrix will

- (a) have a tridiagonal structure with three adjacent diagonals including the main diagonal.
- (b) have a pentadiagonal structure with five adjacent diagonals including the main diagonal.
- (c) have a penta-diagonal structure with three adjacent diagonals and two other diagonals separated diagonals separated by diagonals containing zeroes.
- (d) be the sum of two tri-diagonal matrices each containing three adjacent diagonals.

69. Which of the following fluids is not Newtonian:

- (a) ammonia gas
- (b) mercury
- (c) petrol
- (d) blood

70. The conserved variables that are solved for in MacCormack method are:

- (a) ρ , u , v , w , h
- (b) ρ , ρu , ρv , ρw , ρe

(c) ρ, u, v, w, i

(d) ρ, u, v, w, T

71. Which of the following describes the Beam-Warming method:

(a) Explicit, 1st order accurate in time, 2nd order in space, unconditionally stable

(b) Explicit, 2nd order accurate in time, 2nd order in space, conditionally stable

(c) Implicit, 1st order accurate in time, 2nd order in space, unconditionally stable

(d) **Implicit, 2nd order accurate in time, 2nd order in space, unconditionally stable**

72. Which of the statements is true about the transformation of the Laplace equation into a non-orthogonal curvilinear coordinate system?

(a) The elliptic equation becomes hyperbolic

(b) The elliptic equation becomes parabolic

(c) **The transformed equation remains elliptic**

(d) The transformed equation contains only normal derivatives

Question No	Question	Answer
73	Consider one-dimensional flow governed by $d^2u/dy^2=C$ over a height H . The interval H is divided into 30 equal segments. The upper wall moves to the right at a speed of 1 m/s while the lower wall is stationary. The number of discretized equations are	29
74	How many discretized equations will feature the cell velocities of two or more neighbours:	13
75	Newtonian fluid approximation is a necessary condition for	Navier-Stokes equations
76	As per the Newtonian fluid assumption	Viscous stress is proportional to strain rate

77	How many mass conservation equations do we need to solve?	four
78	Assuming the flow to be three-dimensional, the total number of partial differential equations that need to be solved is	8
79	Boundary conditions over part of the boundary are needed for which type of problem:	hyperbolic
80	Lax theorem states that	Consistency and stability are sufficient for convergence for a well-posed linear initial value problem
81	A grid-independent solution for a well-posed linear initial value problem with a consistent and stable scheme can be expected to agree with	the analytical solution
82	Which of the following schemes may give assurance of convergence with second order accuracy:	Crank-Nicolson's scheme
83	Which of the following will give oscillation-free stable solution with second order accuracy:	None of the above
84	How many equations are needed describe compressible, unsteady two-dimensional flows	five
85	The conserved variables that are solved for in compressible two-dimensional flow are	$\rho, \rho v, \rho w, \rho e_t$
86	Which of the following statements is true about the evaluation of pressure in MacCormack scheme	It is obtained from the equation of state
87	Which of the following statements is true about the explicit MacCormack scheme	None of the above

88	Which of the following describes the Beam-Warming method	Implicit, 2nd order accurate in time, 2nd order in space, unconditionally stable
89	One advantage of the Beam-Warming method over the MacCormack method is	Larger time steps can be used
90	For three-dimensional incompressible flows, the minimum number of partial differential equations to be solved is	4
91	Which of the following describes the solution of the momentum equation in the pressure correction method in steady flows	fully implicit except for non-linear, coupling terms and pressure
92	A staggered grid system is used	to eliminate chequerboard oscillations in pressure
93	Poisson equation is an example of	elliptic equation
94	Which of the following attributes is an advantage of direct methods over iterative methods for the solution of linear algebraic equations	range of applicability
95	The time interval for time-averaging of flow-governing equations should be such that	it should be much larger than the time period of the largest eddy
96	Which of the following statements is true about eddy viscosity?	None of the above
97	We are solving the case of steady, developing turbulent flow between two infinitely wide parallel plates using the k- ϵ turbulence model. For this case, the number of differential equations that we need to solve is	5
98	A control volume based model gives _____ equation.	Integral

99	What is the need of constructing a model for analysing fluids?	Fluids are not stationary and they have different velocities in different parts
100	An equation modelled using infinitesimally small element leads to	Partial differential equation
101	A finite control volume moving along with the flow	Has the same particles always inside it
102	Other than finite control volume and infinitesimal small element, what is the third possible modelling of fluid flow?	Microscopic approach
103	A stationary model will result in	Conservative equation
104	A model of fluid moving along with the flow gives non-conservative equation. What is the reason?	Position coordinates are dependent on time
105	Which of these statements is correct?	Convective term in the momentum equation is non-linear
106	For the incompressible flows, which of these terms will be zero?	Bulk viscosity
107	In which of these approaches is the pressure force treated as a body force?	Finite volume method - conservative approach
108	If the pressure force is not treated as a surface force in the finite volume method, what will happen?	Non-conservative error
109	The difference between the conservative and the non-conservative approaches occurs in the	finite volume method

110	Which of these is correct for extra viscous terms in cylindrical coordinates?	It is treated implicitly when its contribution to the coefficient of the central node is positive
111	Which of these changes do not contribute to a change in momentum in the momentum equation?	Rate of change term
112	In which of these flows is the kinetic energy important?	Incompressible isothermal flows
113	An equation for the conservation of kinetic energy can be obtained by	the product of momentum equations and velocities
114	For incompressible flows with no body forces, the volume integral term is	viscous terms
115	The staggered grid can be used to overcome	decoupling of pressure and velocities
116	Which of these statements is correct when using the staggered grids?	No interpolation is needed to find the pressure gradient in the momentum equation
117	The staggered grid needs no interpolation to get the	velocity field in the continuity equation
118	Which of these is not stored at the cell centres in the staggered grids?	Velocity
119	While using a staggered grid, the velocities are stored in the	face centres
120	What is the advantage of the staggered grid arrangement?	Helps to avoid convergence problems and oscillations
121	Arbitrary Lagrangian-Eulerian method comes under	Partially staggered grid arrangements

122	Which of these statements is correct about the Arbitrary Lagrangian-Eulerian method?	It produces oscillatory pressure or velocity fields
123	Which of these statements is incorrect about the Arbitrary Lagrangian-Eulerian method?	Velocities are stored in the face centres
124	The Arbitrary Lagrangian-Eulerian method is advantageous for	Non-orthogonal grids
125	The pressure correction equation is used to ensure	mass conservation
126	In the incompressible flows, the correction implies a correction in	velocity
127	State the condition obtained by applying the correction to the continuity equation	When the mass flow rate reaches an exact solution, the correction field becomes zero
128	The continuity equation drives the correction field of	velocity
129	In which of these terms of the momentum equation will the correction have no impact?	Surface flux terms
130	The pressure used to find the velocities from the momentum equations is of	the previous time step
131	The correction in the velocity field is used to	correct the pressure field
132	The pressure correction is an	implicit time-dependent method
133	Which of these is a disadvantage of the Navier-Stokes equations?	No independent-equation for pressure
134	Which of these statements is true for an incompressible flow?	Absolute pressure is not important
135	How is pressure calculated in a compressible flow?	Equation of state
136	Which of these equations are used to get the pressure values in the incompressible flows?	Continuity and momentum equations

137	The pressure equation for the incompressible equation is	Poisson equation
138	Which of these terms in the pressure equation become zero?	Viscous and transient terms
139	The pressure equation in the incompressible flows contain	Laplacian operator
140	According to the explicit time-advanced method for getting pressure, which of these is correct?	Continuity is enforced before at each step moving to the next step
141	The explicit method is preferred when	an accurate time history of the flow is needed
142	Which of these is correct for the implicit method of solving pressure in the compressible flows?	The Poisson equation and the momentum equation are solved simultaneously
143	What does SIMPLE stand for?	Semi-Implicit Method for Pressure-Linked Equations
144	The SIMPLE algorithm is a	Predictor-corrector method
145	In the momentum equation for the correction field, which of these terms are neglected?	Neighbouring correction terms
146	Which of these equations are used in the SIMPLE algorithm?	Continuity and momentum equations
147	Which of these equations is/are obtained from the continuity equation?	Pressure-correction equation
148	Which of these statements is correct about the pressure correction equation?	An under-relaxation factor is used to avoid divergence
149	The range of the relaxation factor in the pressure correction equation is	$0 < \text{factor} < 1$

150	Which of these statements is correct about a small relaxation factor?	Computation is stable but convergence is slow
151	A large relaxation factor will lead to	large and oscillatory iteration steps
152	Which of these is correct about the SIMPLE algorithm?	It is simultaneous
153	What does the R in the SIMPLER algorithm stand for?	Revised
154	What is the difference between the SIMPLE and the SIMPLER algorithms?	Pressure is directly calculated
155	What is the disadvantage of using the SIMPLE algorithm over the SIMPLER one?	The velocity field does not satisfy the momentum equation
156	The equation for pressure of the SIMPLER algorithm is obtained using	discretized continuity equation
157	Which of these is correct about the SIMPLER algorithm?	Prediction-correction is used for the velocity field
158	Which of these equations is used in the SIMPLER algorithm for updating the pressure values?	Pressure-correction equation
159	The source term in the pressure equation of the SIMPLER algorithm is obtained using	pseudo-velocities
160	The pseudo-velocities of the SIMPLER algorithm are obtained from	discretized momentum equation
161	The velocity-corrections in the SIMPLER algorithm depends on	pressure corrections
162	What does PISO stand for?	Pressure Implicit with Splitting of Operators
163	How many predictor and corrector steps does the PISO algorithm involve?	One predictor and two corrector steps

164	Which of these methods of solving a system of equations will be needed after using an explicit scheme?	Sequential
165	What is the main disadvantage of explicit schemes in a time-dependent problem?	Small time-step size
166	The Lax-Wendroff technique is	explicit, finite-difference method
167	Which is the technique used to overcome the disadvantages of the Lax-Wendroff technique?	MacCormack's technique
168	What is the source of discretization error in the finite difference method?	Truncation error
169	The exact solution of the partial differential equation varies from the exact solution of the discretized equations by	discretization error
170	What is Richardson extrapolation used for?	To increase the rate of convergence
171	In a two dimensional flow, how many terms does Simpson's rule need to approximate a surface integral?	three terms
172	What happens when the convergence is not monotonic?	Erroneous solutions may converge