Whole ELGI Model Question Paper

Q1. If a bullet is fired in standard air at 15 degree C at the Mach angle of 30 degree C, the velocity of the bullets would be

a) 513.5 m/s
b) 585.5 m/s
c) 645.5 m/s
d) 680.5 m/s

ANS: d

Q2. A pipeline connecting two reservoirs has its diameter reduced by 20% due to deposition of Chemicals. For a given head difference in the reservoirs with unaltered friction factor, this would cause a reduction in discharge of

a) 42.8%
b) 20%
c) 17.8%
d) 10.6%

ANS: a

Q3. A pipe of 20 cm diameter and 30 km length transports oil from a tanker to the shore with a velocity of 0.318 m/s. The flow is laminar. If μ = 0.1 N-m/s2, the power required for the flow would be

a) 9.25 kW
b) 8.36 kW
c) 7.63 kW
d) 10.13 kW

ANS: a

Q4. Separation of fluid flow is caused by

a) reduction of pressure in the direction of flow

b) reduction of the boundary layer thickness
c) presence of adverse pressure gradient
d) presence of favourable pressure gradient
e) presence of adverse pressure gradient

ANS: c

Q5. An automobile moving at a velocity of 40 km/hr is experiencing a wind resistance of 2kN. If the automobile is moving at a velocity of 50 km/hr, the power required to overcome the wind resistance is

a) 43.4 kW
b) 3.125 kW
c) 2.5 kW
d) 27.776 kW

ANS: a

Q6. The air with enthalpy of 100 kJ/kg is compressed by an air compressor to a pressure and temperature at which its enthalpy becomes 200 kJ/kg. The loss of heat is 40kJ/kg from the compressor as the air passes through it. Neglecting kinetic and potential energies, the power required for an air mass flow of 0.5 kg/s is

a) 30 kW
b) 50 kW
c) 70 kW
d) 90 kW

ANS: a

Q7. The process 1-2 for steam shown in the given figure is

a) isobaric
b) isentropic

c) isenthalpic
d) isothermal

ANS: c

Q8. The capacity of an air compressor is specified as 10 m3/min. It means that the compressor is capable of

a) supplying 3 m3 of compressed air per minute
b) compressing 3 m3 of free air per minute
c) supplying 3 m3 of compressed air at NTP
d) compressing 3 m3 of standard air per minute

ANS: a

Q9. In a petrol engine car, which one of the following performance characteristics is affected by the front-end volatility of the gasoline used?

a) Hot starting and vapour lock
b) Engine warm -up and spark plug fouling
c) Spark plug fouling and hot starting
d) Vapour lock, engine warm -up and spark plug fouling

ANS: d

Q10. Shielding in a nuclear reactor is generally done to protect against

a) excess electrons
b) X-rays
c) a and ß rays
d) neutron and gamma rays

ANS: d

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Q11. The gross head available to hydraulic power plant is 100 m. The utilised head in the runner of the hydraulic turbine is 72 m. If the hydraulic efficiency of the turbine is 90% , the pipe friction head is estimated to be

a) 20 m
b) 18 m
c) 16.2 m
d) 1.8 m

ANS: a

Q12. For the fully developed laminar flow and heat transfer in a uniformly heated long circular tube, if the flow velocity is doubled and the tube diameter is halved, the heat transfer coefficient will be

a) double of the original value
b) half of the original value
c) same as before
d) four times of the original value

ANS: b

Q13. The Nusselt number is related to Reynolds number in laminar and turbulent flows respectively as

a) Re -1/2 and Re 0.8
b) Re 1/2 and Re 0.8
c) Re -1/2 and Re -0.8
d) Re 1/2 and Re -0.8

ANS: b

Q14. The COP of a heat pump ßHP and the COP of a refrigerator ßRef are related as

a) ßHP + ßRef
b) ßHP - ßRef = 1
c) ßRef - ßHP = 1
d) ßHP - ßRef = 0

ANS: b

Q15. In respect of free convection over a vertical flat plate the Nusselt number varies with Grashof number Gr as

a) Gr and Gr1/2 for laminar and turbulent flows respectively
b) Gr 1/2 and Gr1/3 for laminar and turbulent flows respectively
c) Gr1/4 and Gr1/3 for laminar and turbulent flows respectively
d) Gr1/3 and Gr1/4 for laminar and turbulent flows respectively

ANS: a

Q16. The plot for the pressure ratio along the length of the convergent-divergent nozzle is shown in the given figure. The sequence of the flow conditions labelled 1,2,3, and 4 in the figure is respectively

a) supersonic, sonic, subsonic and supersonic
b) sonic, supersonic, subsonic and supersonic
c) subsonic, supersonic, sonic and subsonic
d) subsonic, sonic, supersonic and subsonic

ANS: d

Q17. Which one of the following sets of standard flows is uperimposed to represent the flow around a rotating cylinder?

a) Doublet, vortex and uniform flow
b) Source, vortex and uniform flow
c) Sink, vortex and uniform flow
d) Vortex and uniform flow

ANS: a

Q18. The enthalpies at the beginning of compression, at the end of compression and at the end of condensation are respectively 185 kJ/kg and 85 kJ/kg. The COP of the vapour compression refrigeration system is

a) 0.25
b) 5.4
c) 4
d) 1.35

ANS: c

Q19. If the full -scale turbine is required to work under a head of 30 m and to run at 428 r.p.m., then a quarter-scale turbine model tested under a head of 10 m must run at

a) 143 r.p.m.
b) 341 r.p.m.
c) 428 r.p.m.
d) 988 r.p.m.

ANS: d

Q20. Heat transfer by radiation between two grey bodies of emissivity e is proportional to (notations have their usual meanings)

a) (Eb - J)
(I - e)
b) (Eb - J)
(I - e) /e
c) (Eb - J)
(I - e)2
d) (Eb - J)

(I - e2)

ANS: b

Q21. A float of cubical shape has sides of 10 cm. The float valve just touches the valve seat to have a flow area of 0.5 cm2 as shown in the given figure. If the pressure of water in the pipeline is 1 bar, the rise of water level h in the tank to just stop the water flow will be

a) 7.5 cm
b) 5.0 cm
c) 2.5 cm
d) 0.5 cm

ANS: b

Q22. A copper wire of radius 0.5 mm is insulated with a sheathing of thickness 1 mm having a thermal conductivity of 0.5 W/m-K. The outside convective heat transfer coefficient is 10W/m2-K. If the thickness of insulation sheathing is raised by 10 mm, then the electrical current-carrying capacity of the wire will

a) increase
b) decrease
c) remain the same
d) vary depending upon the electrical conductivity of the wire

ANS: c

Q23. A U-tube manometer is connected to a pipeline conveying water as shown in the given figure. The pressure head of water in the pipeline is

a) 7.12 m
b) 6.56 m
c) 6.0 m
d) 5.12

ANS: c

Q24. Improve streamlining produces 25% reduction in the drag coefficient of a torpedo. When it is travelling fully submerged and assuming the driving power to remain the same, the increase in speed will be

a) 10 %
b) 20 %
c) 25 %
d) 30 %

ANS: a

Q25. The height of a cylindrical container is twice that of its diameter. The ratio of the horizontal forces on the wall of the cylinder when it is completely filled to that when it is half filled with the same liquid is

a) 2
b) 3
c) 3.5
d) 4

ANS: a

Q26. A composite plane wall is made up of two different materials of the same thickness and having a thermal conductivities of k1 and k2 respectively. The equivalent thermal conductivity of the slab is

a) k1+ k2
b) k1k2
c) $\frac{k1+ k2}{k1k2}$
d) $\frac{2k1k2}{k1+ k2}$

ANS: c

Q27. The eye of a tornado has a radium of 40 m. If the maximum wind velocity is 50 m/s, the velocity at a distance of 80 m radius is

a) 100 m/s
b) 2500 m/s
c) 31.25 m/s
d) 25 m/s

ANS: d

Q28. The outer surface of a long cylinder is maintained at constant temperature. The cylinder does not have any heat source. The temperature in the cylinder will

a) increase linearly with radius
b) decrease linearly with radius
c) be independent of radius
d) vary logarithmically with radius

ANS: c

Q29. If a vessel containing liquid moves downward with constant acceleration d, then

a) the pressure throughout the liquid mass is atmosphere
b) the pressure in the liquid mass is greater than the hydrostatic pressure
c) there will be vacuum in the liquid
d) the pressure throughout the liquid mass is greater than atmosphere

ANS: d

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Q30. A stream function is given by (x2-y2). The potential function of the flow will be

a) 2xy + f(x)
b) 2xy + constant
c) 2(x2-y2)
d) 2xy + f(y)

ANS: b

Q31. A pipe is connected in series to another pipe diameter is twice and length is 32 times that of the first pipe. The ratio of frictional head losses for the first pipe to those for the second pipe is (both the pipes have the same frictional constant)

a) 8
b) 4
c) 2
d) 1

ANS: d

Q32. A tank containing water has two orifices of the same size at depths of 40 cm and 90 cm below the free surface of water. The ratio of discharges through these orifices is

a) 1:1
b) 2:3
c) 4:9
d) 16:81

ANS: b

Q33. When pressure drag over a body is large as compared to the friction drag, then the shape of the body is that of

a) an aerofoil
b) a streamlined body
c) a two-dimensional body
d) a bluff body

ANS: d

Q34. Which one of the following pairs of formulae represents the specific speeds of turbine and pump respectively? (Notations have their usual meanings)

a) NQ 1/2 and NP1/2
H3/4 H5/4
b) NQ 1/2 and NP1/2
H3/4 H3/4
c) NP1/2 and NQ1/2
H3/4 H5/4
d) NP 1/2 and NQ1/2
H5/4 H3/4

ANS: d

Q35. The velocities and corresponding flow areas of the branches labelled 1,2,3,4 and 5 for a pipe system shown in the given figure are given in the following table :

Pipe Label I Velocity Area
1 5 cm/s 4 sq cm
2 6 cm/s 5 sq cm
3 V3 cm/s 2 sq cm
4 4 cm/s 10 sq cm
5 V5 cm/s 8 sq cm

a) 2.5 cm/s
b) 5 cm/s
c) 7.5 cm/s
d) 10 cm/s

ANS: b

Q36. A Pilot static tube is used to measure the velocity of water using a differential gauge which contains a manometric fluid of relative density 1.4. The deflection of the gauge fluid when water flows at a velocity of 1.2 m/s will be (the coefficient of the tube may be assumed to be

a) 183.5 mm
b) 52.4 mm
c) 5.24 mm
d) 73.4 mm

ANS: b

Q37. In a turbulent boundary layer over the entire length of a plate, the boundary layer thickness increases with its distance X from the leading edge as

a) X 1/2
b) X1/5
c) X2/5
d) X4/5

ANS: d

Q38. Which one of the following statements is correct?

a) Hydraulic grade line and energy grade line are the same in fluid flow problems
b) Energy grade line lies above the hydraulic grade line and is always parallel to it
c) Energy grade line lies above the hydraulic grade line and they are separated from each other by a vertical distance equal to the velocity head
d) The hydraulic grade line slopes upwards meeting the energy grade line only at the exit of flow

ANS: c

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Q39. Reciprocating compressors are provided with

a) simple disc/plate valve
b) poppet valve
c) spring-loaded disc valve
d) solenoid valve

ANS: a

Q40. If laminar flow takes place in two pipes, having relative roughnesses of 0.002 and 0.003, at a Reynolds number of 1815, then

a) the pipe of relative roughness of 0.003 has a higher friction factor
b) the pipe of relative roughness of 0.003 has a lower friction factor
c) both pipes have the same friction factor
d) no comparison is possible due to inadequate data

ANS: a

Q41. The development of boundary layer zones labelled P,Q, R and S over a flat plate is shown in the given figure
Based on this figure, match List (Boundary layer zones) with List II (Types of boundary layer) and select the correct answer using the codes given below the Lists :
List -I List -II

a) P 1. Transitional
b) Q 2. Laminar viscous sub-layer
c) R 3. Laminar
d) S 4. Turbulent

Codes :
A B C D

a) 3 1 2 4

b) 3 2 1 4
c) 4 2 1 3
d) 4 1 2 3

ANS: a

Q42. A circular cylinder of 400 mm diameter is rotated about its axis in a stream of water having a uniform velocity of 4 m/s. When both the stagnation points coincide, the lift force experienced by the cylinder is

a) 160 kN/m
b) 10.05 kN/m
c) 80 kN/m
d) 40.2 kN/m

ANS: b

Q43. If the upstream Mach number of a normal shock occurring in air (k=1.4) is 1.68, then the Mach number after the shock is

a) 0.84
b) 0.646
c) 0.336
d) 0.564

ANS: b

Q44. Consider the following statements:

i) The first law of thermodynamics is a law of conservation of energy
ii) Perpetual motion machine of the first kind converts energy into euivalent work
iii) A closed system does not exchange work or energy with its surroundings
iv) The second law of thermodynamic stipulates the law of conservation of energy and entropy.

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Which of the statements are correct?

a) (i) and (iii)
b) (ii) and (iv)
c) (ii), (iii) and (iv)
d) (i), (ii) and (iii)

ANS: d

Q45. When a cylinder is placed in an ideal fluid and the flow is uniform, the pressure coefficient Cp is equal to

a) 1-sin2?
b) 1- 2 sin2?
c) 1- 4 sin2?
d) 1- 8 sin2?

ANS: a

Q46. Which one of the following sets of thermodynamic laws/ relations is directly involved in determining the final properties during an adiabatic mixing process?

a) The first and second laws of thermodynamics
b) The second law of thermodynamics and steady flow relations
c) Perfect gas relationship and steady flow relations
d) The first law of thermodynamics and perfect gas relationship

ANS: d

Q47. A heat engine receives 1000 kW of heat at a constant temperature of 285 degree C and rejects 492 kW of heat at 5 degree C. Consider the following thermodynamic cycles in this regard:

(i) Carnot cycle
(ii) Reversible cycle

(iii) Irreversible cycle

Which of these cycles could possible be executed by the engine?

a) 1 alone
b) 3 alone
c) 1 and 2
d) None 1, 2 and 3

ANS: a

Q48. Consider the following statements:

When dry saturated steam is throttled from a higher pressure to a lower pressure, the

a) pressure decreases and the volume increases
b) temperature decreases and the steam becomes superheated
c) temperature and the dryness fraction increase
d) entropy increases without any change in enthalpy

ANS: a

Q49. The internal energy of a gas obeying vander Waals equation (p + a/V2) (v-b) = RT depends on its

a) temperature
b) temperature and pressure
c) temperature and specific volume
d) pressure and specific volume

ANS: b

Q50. In which one of the following working substances, does the relation T2 = (P2) 0.286 hold good if the process takes place with zero heat transfer? T1 P1

a) West steam
b) Superheated steam
c) Petrol vapour and air mixture
d) Air

ANS: b

Q51. Consider the following statements:

A real gas obeys perfect gas law at very

(i) high temperature
(ii) high pressure
(iii) low pressures

Which of these statements is/are correct?

a) (i) alone
b) (i) and (iii)
c) (ii) alone
d) (iii) alone

ANS: d

Q52. A two-stage compressor takes in air at 1.1 bars and discharges at 20 bars. For maximum efficiency, the intermediate pressure is

a) 10.55 bars
b) 7.33 bars
c) 5.5 bars
d) 4.7 bars

ANS: d

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Q53. In a steam power plant, the ratio of the isentropic heat drop in the prime mover to the amount of heat supplied per unit mass of steam is known as

a) stage efficiency
b) degree of reaction
c) Rankine efficiency
d) relative efficiency

ANS: c

Q54. In turbo prop, the expansion of gases takes place approximately

a) 100% in the turbine
b) 80% in the turbine and 20% in the nozzle
c) 50% in the turbine and 50% in the nozzle
d) 100% in the nozzle

ANS: a

Q55. In which one of the following situations the entropy change will be negative

a) Air expands isothermally from 6 bars to 3 bars
b) Air is compressed to half the volume at constant pressure
c) Hear is supplied to air at constant volume till the pressure becomes three folds
d) air expands is entropically from 6 bars to 3 bars

ANS: a

Q56. For the same maximum pressure and heat input, the most efficient cycle is

a) Otto cycle
b) Diesel cycle
c) Brayton cycle
d) Dual combustion cycle

ANS: a

Q57. Partial admission steam turbine refers to the situation where the

a) steam is admitted partially into the blades through nozzles
b) nozzles occupy the completer circumference leading into the blade annulum
c) nozzles do not occupy the complete circumference leading into the annulus
d) steam is admitted partially into the blades directly.

ANS: a

Q58. The most commonly used moderator in Nuclear power plants is

a) heavy water
b) concrete and bricks
c) steel
d) graphite

ANS: d