SECTION-B

[Only for candidates appearing in QURAT July'19 -DEPARTMENT OF M.E]

51- The Blasius equation related to boundary layer theory is a

a. third-order linear partial differential equation
b. third-order nonlinear partial differential equation
c. second-order nonlinear ordinary differential equation
d. third-order nonlinear ordinary differential equation

52- For flow of viscous fluid over a flat plate, if the fluid temperature is the same as the plate temperature, the thermal boundary layer is

a. thinner than the velocity boundary layer
b. thicker than the velocity boundary layer
c. of the same thickness as the velocity boundary layer
d. not formed at all

53- For an ideal gas with constant values of specific heats, for calculation of the specific enthalpy,

a. it is sufficient to know only the temperature
b. both temperature and pressure are required to be known
c. both temperature and volume are required to be known
d. both temperature and mass are required to be known.

44- Three vendors were asked to supply a very high precision component. The respective probabilities of their meeting the strict design specifications are 0.8, 0.7 and 0.5. Each vendor supplies one component. The probability that out of total three components supplied by the vendors, at least one will meet the design specification is _____

a. 0.96-0.98
b. 1-1.02
c. 0.54-0.56
d. 2-4

55- A small ball of mass 1 kg moving with a velocity of 12 m/s undergoes a direct central impact with a stationary ball of mass 2 kg. The impact is perfectly elastic. The speed (in m/s) of 2 kg mass ball after the impact will be _____

a. 7.8-8.2
b. 6.5-7.5
c. 2.3-3.4
d. 1.0-1.5

56- A rod is subjected to a uni-axial load within linear elastic limit. When the change in the stress is 200 MPa, the change in the strain is 0.001. If the Poisson's ratio of the rod is 0.3, the modulus of rigidity (in GPa) is _____

a. 76-78
b. 90-95
c. 80-85
d. 50-60

57- A gas is stored in a cylindrical tank of inner radius 7 m and wall thickness 50 mm. The gage pressure of the gas is 2 MPa. The maximum shear stress (in MPa) in the wall is

a. 35 b. 70 c. 140 d. 280

58- In a spring-mass system, the mass is m and the spring constant is k. The critical damping coefficient of the system is 0.1 kg/s. In another spring-mass system, the mass is 2m and the spring constant is 8k. The critical damping coefficient (in kg/s) of this system is _____

a. 0.38-0.42
b. 0.50-0.55
c. 0.65-.070
d. 0.75-0.80

59- The uniaxial yield stress of a material is 300 MPa. According to von Mises criterion, the shear yield stress (in MPa) of the material is _____

a. 171-175
b. 180-182
c. 190-195
d. 200-208

60- Which one of the following statements is TRUE?

a. The 'GO' gage controls the upper limit of a hole
b. The 'NO GO' gage controls the lower limit of a shaft
c. The 'GO' gage controls the lower limit of a hole
d. The 'NO GO' gage controls the lower limit of a hole

61- During the development of a product, an entirely new process plan is made based on design logic, examination of geometry and tolerance information. This type of process planning is known as

a. retrieval b. generative
c. variant d. group technology based

62- A plastic sleeve of outer radius r0 = 1 mm covers a wire (radius r = 0.5 mm) carrying electric current. Thermal conductivity of the plastic is 0.15 W/m-K. The heat transfer coefficient on the outer surface of the sleeve exposed to air is 25 W/m2-K. Due to the addition of the plastic cover, the heat transfer from the wire to the ambient will

a. increase
b. remain the same
c. decrease
d. be zero

63- Which of the following statements are TRUE with respect to heat and work?
(i) They are boundary phenomena
(ii) They are exact differentials
(iii) hey are path functions
a. both (i) and (ii)
b. both (i) and (iii)
c. both (ii) and (iii)
d. only (iii)

64- Propane (C3H8) is burned in an oxygen atmosphere with 10% deficit oxygen with respect to the stoichiometric requirement. Assuming no hydrocarbons in the products, the volume percentage of CO in the products is _____
a) 10-12
b) 2-6
c) 13.7-14.9
d) 18.8-19.85

65- Consider two hydraulic turbines having identical specific speed and effective head at the inlet. If the speed ratio (N1/N2) of the two turbines is 2, then the respective power ratio (P1/P2) is _____
a. 0.15-0.18
b. 0.19-0.22
c. 0.24-0.26
d. 0.28-0.30

66- The INCORRECT statement about regeneration in vapor power cycle is that
a. it increases the irreversibility by adding the liquid with higher energy content to the steam generator.
b. heat is exchanged between the expanding fluid in the turbine and the compressed fluid before heat addition
c. the principle is similar to the principle of Stirling gas cycle
d. it is practically implemented by providing feed water heaters

67- In a linearly hardening plastic material, the true stress beyond initial yielding
a. increases linearly with the true strain
b. decreases linearly with the true strain
c. first increases linearly and then decreases linearly with the true strain
d. remains constant

68- Using the Taylor's tool life equation with exponent 0.5, n if the cutting speed is reduced by 50%, the ratio of new tool life to original tool life is
a. 4
b. 2
c. 1
d. 0.5

69- A grinding ratio of 200 implies that the
a. grinding wheel wears 200 times the volume of the material removed
b. grinding wheel wears 0.005 times the volume of the material removed
c. aspect ratio of abrasive particles used in the grinding wheel is 200
d. ratio of volume of abrasive particle to that of grinding wheel is 200

70- Interpolator in a CNC machine
a. controls spindle speed
b. coordinates axes movements
c. operates tool changer
d. commands canned cycle

71- The time series forecasting method that gives equal weightage to each of the m most recent observations is
a. Moving average method
b. Exponential smoothing with linear trend
c. Triple Exponential smoothing
d. Kalman Filter

72- The number of atoms per unit cell and the number of slip systems, respectively, for a facecentered cubic (FCC) crystal are
a. 3, 3
b. 3, 12
c. 4, 12
d. 4, 48

73- Metal removal in electric discharge machining takes place through
a. ion displacement
b. melting and vaporization
c. corrosive reaction
d. plastic shear

74- The preferred option for holding an odd-shaped workpiece in a centre lathe is
a. live and dead centres
b. three jaw chuck
c. lathe dog
d. four jaw chuck

75- A local tyre distributor expects to sell approximately 9600 steel belted radial tyres next year. Annual carrying cost is Rs. 16 per tyre and ordering cost is Rs. 75. The economic order quantity of the tyres is
a. 4
b. 212
c. 300
d. 1200

76- For a canteen, the actual demand for disposable cups was 500 units in January and 600 units in February. The forecast for the month of

January was 400 units. The forecast for the month of March considering smoothing coefficient as 0.75 is _____

a. 100-200
b. 300-400
c. 800-900
d. 568-570

77- An orthogonal turning operation is carried out under the following conditions: rake angle = 5º; spindle rotational speed = 400 rpm; axial feed = 0.4 m/min and radial depth of cut = 5 mm. The chip thickness, tc, is found to be 3 mm. The shear angle (in degrees) in this turning process is_____

a. 5-5.5
b. 8-8.5
c. 12.5-13
d. 18.5-19.0

78- A 10 mm diameter electrical conductor is covered by an insulation of 2 mm thickness. The conductivity of the insulation is 0.08 W/m-K and the convection coefficient at the insulation surface is 10 W/m2-K. Addition of further insulation of the same material will

a. increase heat loss continuously
b. decrease heat loss continuously
c. increase heat loss to a maximum and then decrease heat loss
d. decrease heat loss to a minimum and then increase heat loss

79- In a certain slider-crank mechanism, lengths of crank and connecting rod are equal. If the crank rotates with a uniform angular speed of 14 rad/s and the crank length is 300 mm, the maximum acceleration of the slider (in m/s2) is _____

a. 100-105
b. 115-120
c. 135-140
d. 150-155

80- A single-degree-freedom spring-mass system is subjected to a sinusoidal force of 10 N amplitude and frequency ω along the axis of the spring. The stiffness of the spring is 150 N/m, damping factor is 0.2 and the undamped natural frequency is 10 ω . At steady state, the amplitude of vibration (in m) is approximately

a) 0.05
b) 0.07
c) 0.70
d) 0.90

81- A hollow shaft of 1 m length is designed to transmit a power of 30 kW at 700 rpm. The maximum permissible angle of twist in the shaft is 1°. The inner diameter of the shaft is 0.7 times the outer diameter. The modulus of rigidity is 80 Gpa. The outside diameter (in mm) of the shaft is_____

a. 22-25
b. 28-32
c. 43-45
d. 48-50

82- A hollow shaft (do = 2di where do and di are the outer and inner diameters respectively) needs to transmit 20 kW power at 3000 RPM. If the maximum permissible shear stress is 30 MPa, do is

a. 11.29 mm
b. 22.58 mm
c. 33.87 mm
d. 45.16 mm

83- The total emissive power of a surface is 500 W/m2 at a temperature $T/T1$ and 1200 W/m2 at a temperature $T/T2$, where the temperatures are in Kelvin. Assuming the emissivity of the surface to be constant, the ratio of the temperatures $T/T1$ and $T/T2$ is

a. 0.308
b. 0.416
c. 0.803
d. 0.874

84- The head loss for a laminar incompressible flow through a horizontal circular pipe is h1. Pipe length and fluid remaining the same, if the average flow velocity doubles and the pipe diameter reduces to half its previous value, the head loss is h2. The ratio h2/h1 is

a. 1
b. 4
c. 8
d. 16

85- For a fully developed laminar flow of water (dynamic viscosity 0.001 Pa-s) through a pipe of radius 5 cm, the axial pressure gradient is −10 Pa/m. The magnitude of axial velocity (in m/s) at a radial location of 0.2 cm is _____

a. 6.2-6.3
b. 8.2-8.3
c. 10-12
d. 14-16

86- A balanced counterflow heat exchanger has a surface area of 20 m2 and overall heat transfer coefficient of 20 W/m2-K. Air (Cp=1000 J/kg-K) entering at 0.4 kg/s and 280 K is to be preheated by the air leaving the system at 0.4 kg/s and 300 K. The outlet temperature (in K) of the preheated air is

a. 290
b. 300
c. 320
d. 350

87- A cylindrical uranium fuel rod of radius 5 mm in a nuclear reactor is generating heat at the rate of 4×107 W/m3. The rod is cooled by a liquid (convective heat transfer coefficient 1000 W/m2-K) at 25 °C. At steady state, the surface temperature (in K) of the rod is

a. 308
b. 398
c. 418
d. 448

88- Work is done on an adiabatic system due to which its velocity changes from 10 m/s to 20 m/s, elevation increases by 20 m and temperature increases by 1 K. The mass of the system is 10 kg, Cv = 100 J/(kg.K) and gravitational acceleration is 10 m/s2. If there is no change in any other component of the energy of the system, the magnitude of total work done (in kJ) on the system is

a. 3.5
b. 4.5
c. 5.5
d. 6.5

89- In a Rankine cycle, the enthalpies at turbine entry and outlet are 3159 kJ/kg and 2187 kJ/kg, respectively. If the specific pump work is 2 kJ/kg, the specific steam consumption (in kg/kW-h) of the cycle based on net output is _____

a. 3.6-3.8
b. 4-4.5
c. 4.6-4.9
d. 5.6-5.9

90- A cube and a sphere made of cast iron (each of volume 1000 cm3) were cast under identical conditions. The time taken for solidifying the cube was 4 s. The solidification time (in s) for the sphere is _____

a. 5.5-5.9
b. 6.0-6.3
c. 6.5-6.8
d. 7.0-7.3

91- In a two-stage wire drawing operation, the fractional reduction (ratio of change in cross-sectional area to initial cross-sectional area) in the first stage is 0.4. The fractional reduction in the second stage is 0.3. The overall fractional reduction is

a. 0.24
b. 0.58
c. 0.60
d. 1.00

92- The flow stress (in MPa) of a material is given by

σ = 500ε^0.1, where

ε is true strain. The Young's modulus of elasticity of the material is 200 Gpa. A block of thickness 100 mm made of this material is compressed to 95 mm thickness and then the load is removed. The final dimension of the block (in mm) is _____

a. 88-89
b. 90-92
c. 95.14-95.20
d. 98.14-98.88

93- During a TIG welding process, the arc current and arc voltage were 50 A and 60 V, respectively, when the welding speed was 150 mm/min. In another process, the TIG welding is carried out at a welding speed of 120 mm/min at the same arc voltage and heat input to the material so that weld quality remains the same. The welding current (in A) for this process is

a. 40.00
b. 44.72
c. 55.90
d. 62.25

94- A single point cutting tool with 0° rake angle is used in an orthogonal machining process. At a cutting speed of 180 m/min, the thrust force is 490 N. If the coefficient of friction between the tool and the chip is 0.7, then the power consumption (in kW) for the machining operation is _____

a. 1.8-2.0
b. 2.0-2.2
c. 2.4-2.6
d. 2.8-3.0

95- A fluid (Prandtl number, Pr = 1) at 500 K flows over a flat plate of 1.5 m length, maintained at 300 K. The velocity of the fluid is 10 m/s. Assuming kinematic viscosity, ν = 30 × 10−6 m2/s, the thermal boundary layer thickness (in mm) at 0.5 m from the leading edge is _____

a. 3.1-3.8
b. 4.2-4.8
c. 5.90-6.2
d. 6.6-6.9

96- For water at 25 °C, dps/dTs = 0.189 kPa/K (ps is the saturation pressure in kPa and Ts is the saturation temperature in K) and the specific volume of dry saturated vapour is 43.38 m3/kg. Assume that the specific volume of liquid is negligible in comparison with that of vapour. Using the Clausius-Clapeyron equation, an estimate of the enthalpy of evaporation of water at 25 °C (in kJ/kg) is _____

a. 1500-1600
b. 1700-1800
c. 2000-2200
d. 2400-2500

97- An ideal gas undergoes a reversible process in which the pressure varies linearly with volume. The conditions at the start (subscript 1) and at the end (subscript 2) of the process with usual notation are: p1 = 100 kPa, V1 = 0.2 m3 and 2 = 200 kPa, V2 = 0.1 m3 and the gas constant, R = 0.275 kJ/kg-K. The magnitude of the work required for the process (in kJ) is _____

a. 11-75-12.75
b. 12.90-13.70
c. 14.75-15.25
d. 16-17

98- Following data correspond to an orthogonal turning of a 100 mm diameter rod on a lathe. Rake angle: o 15 ; Uncut chip thickness: 0.5 mm; nominal chip thickness after the cut: 1.25 mm. The shear angle (in degrees) for this process is _____ (correct to two decimal places).

a. 22-24
b. 26-28
c. 30-32
d. 34-36

99- Taylor's tool life equation is used to estimate the life of a batch of identical HSS twist drills by drilling through holes at constant feed in 20 mm thick mild steel plates. In test 1, a drill lasted 300 holes at 150 rpm while in test 2, another drill lasted 200 holes at 300 rpm. The maximum number of holes that can be made by another drill from the above batch at 200 rpm is _____ (correct to two decimal places).

a. 252-254
b. 255-257
c. 258-260
d. 261-263

100- For sand-casting a steel rectangular plate with dimensions 80 mm × 120 mm × 20 mm, a cylindrical riser has to be designed. The height of the riser is equal to its diameter. The total solidification time for the casting is 2 minutes. In Chvorinov's law for the estimation of the total solidification time, exponent is to be taken as 2. For a solidification time of 3 minutes in the riser, the diameter (in mm) of the riser is _____ (correct to two decimal places).

a. 32-41
b. 42-52
c. 61-81
d. 88-90