UPSEE 2019

PAPER-ME: CODE AA*

ANSWER KEY, Examination Date: 21-04-2019

1	C	26	C	51	A	76	B
2	A	27	B	52	A	77	C
3	A	28	D	53	C	78	C
4	C	29	A	54	D	79	A
5	D	30	C	55	D	80	B
6	C	31	D	56	A	81	B
7	B	32	B	57	B	82	B
8	A	33	B	58	B	83	C
9	D	34	C	59	D	84	D
10	B	35	D	60	D	85	A
11	D	36	A	61	C	86	D
12	B	37	A	62	D	87	D
13	B	38	D	63	A	88	C
14	A	39	A	64	D	89	C
15	B	40	C	65	D	90	C
16	B	41	A	66	D	91	D
17	B	42	C	67	D	92	C
18	A	43	A	68	A	93	C
19	A	44	B	69	C	94	A
20	B	45	C	70	C	95	C
21	D	46	B	71	D	96	C
22	C	47	C	72	B	97	A
23	B	48	A	73	D	98	A
24	A	49	A	74	B	99	C
25	D	50	A	75	A	100	A

Note: In case of any grievance, it must be reported at upseegrievance@aktu.ac.in along with Students Roll No. with Paper Code, Question Booklet Code, Question No. and suggested answer with supporting documents on or before 03rd May 2019.

*प्रश्न पुस्तिका क्रमांक **AA** का प्रश्नपत्र एवं कुंजी प्रकाशित की जा रही है। प्रश्न पुस्तिका क्रमांक **BB, CC** तथा **DD** में प्रश्नों एवं उनके विकल्पों का क्रम परिवर्तित है कृपया तद्नुसार उत्तर मिलान करें।

No. of Pages in Booklet including title	**16**	Time **2** Hours	Marks **400**	No. of Questions in Booklet	**100**

ME

Question Booklet Sr. No.

Roll No.

Signature of the Invigilator

Name of Candidate :

Q. Booklet Code

AA

INSTRUCTIONS TO CANDIDATE

1. Use BLUE or BLACK BALL POINT PEN only for all entries and for filling the bubbles in the OMR Answer Sheet.

2. Before opening the SECURITY SEAL of the question booklet, write your Name, Roll Number (In figures), and OMR Answer-sheet Number in the space provided at the top of the Question Booklet. Non-compliance of these instructions would mean that the Answer Sheet can not be evaluated leading the disqualification of the candidate.

3. Each question carries FOUR marks. There will be negative marking on wrong answer. FOUR marks will be awarded for each correct answer and ONE mark will be deducted for each wrong answer. No marks will be deducted/awarded for unattempted questions.

4. Each multiple choice question has only one correct answer. More than one answer indicated against a question will be treated as incorrect answer.

5. Use of log table, mobile phones, any electronic gadget and slide rule etc. is strictly prohibited. Non-programmable calculator is permitted.

6. Candidate will be allowed to leave the examination hall at the end of examination time period only.

7. If a candidate is found in possession of books or any other printed or written material from which he/she might derive assistance, he/she is liable to be treated as disqualified. Similarly, if a candidate is found giving or obtaining (or attempting to give or obtain) assistance from any source, he/she is liable to be disqualified.

8. OMR sheet is placed within this paper and can be taken out from this paper but seal of paper must be opened only at the start of paper.

9. This booklet contains TWO Sections, Section A (Aptitude & Mathematics) has 30 Questions to be attempted and Section B (Subject domain) has 70 Questions to be attempted.

ME

Section - A :
General Aptitude   : Q. 1 to Q. 15
Mathematics   : Q. 16 to Q. 30

Section - B :
Mechanical Engineering   : Q. 31 to Q. 100

Section - A : General Aptitude

001. Antonym of word "Dissent" is:

(A) Renounce   (B) Adopt

(C) Agree   (D) Give

002. Synonym of work "Impudent" is:

(A) Insolent   (B) Partial

(C) Bankrupt   (D) Restive

003. Find out which part of the sentence has an error. If there is no mistake, the answer is 'No error'

(A) I have seen

(B) that film last year

(C) but I do not remember its story

(D) No error

004. Chose the correct meaning of the phrase "To get into hot water":

(A) To be impatient

(B) To suffer huge financial loss

(C) To get into trouble

(D) To be in confused state of mind

005. Find out the word with correct spelling:

(A) Brassere

(B) Brissiere

(C) Brasiiere

(D) Brassiere

006. The value of 25-5 [2+3{2-2(5-3)+5}-10]÷4 is

(A) 5   (B) 23.25

(C) 23.75   (D) 25.75

007. If the sum of a number and its square is 182, what is the number?

(A) 12   (B) 13

(C) 28   (D) 91

008. The sum of the ages of a father and his son is 45 years. Five years ago, the product of their ages was 34. The ages of the son and the father are respectively:

(A) 6 and 39   (B) 7 and 38

(C) 9 and 36   (D) 11 and 34

009. A number, when 35 is subtracted from it, reduces to its 80%. What is four fifth of that number?

(A) 70   (B) 90

(C) 120   (D) 140

010. If the ratio of areas of two circles is 4:9 then the ratio of their circumstances will be:

(A) 3:2   (B) 2:3

(C) 4:9   (D) 9:4

011. Army is related to Soldier as Galaxy is related to:

(A) Planet   (B) Satellite

(C) Meteor   (D) Star

012. IGH:TRS::?:KIJ

(A) POQ   (B) QOP

(C) OPQ   (D) QPO

013. '1+2+3' stands for the 'the brave boy' '2+3+4' stands for 'brave boy swims' '1+2+4+5' stands for 'the brave girl swims'. What stand for 'brave'?

(A) 1   (B) 2

(C) 3   (D) 4

014. Manipulate the symbol and find the missing number.

If   3*6=18

     4*7=22

     9*1=20

then 5*2 =?

(A) 14   (B) 10

(C) 7   (D) 3

015. In a row of children, Kamal is sixth from the left and Appu is fourth from the right. When Kamal and Appu exchange positions, Appu becomes seventeenth from the right. Which will be Kamal's position from the left?

(A) Twentieth

(B) Nineteenth

(C) Twenty-first

(D) Seventh

Section - A : M. Tech.: Part A-(ii) Mathematics

016. If $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$, then

(A) $A^2 = A^{-1}$　　(B) $A^3 = A^{-1}$

(C) $A^4 = A^{-1}$　　(D) $A^5 = A^{-1}$

where A^{-1} is the inverse matrix of A.

017. The rank of the matrix

$A = \begin{bmatrix} 1 & 1 & -1 & 1 \\ -1 & 1 & -3 & -3 \\ 1 & 0 & 1 & 2 \\ 1 & -1 & 3 & 3 \end{bmatrix}$ is

(A) 1　　　　　(B) 2

(C) 3　　　　　(D) 4

018. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ then for every integer n ≥3

(A) $A^n = A^{n-2} + A^2 - I$

(B) $A^n = A^{n-2} - A^2 + I$

(C) $A^n = A^{n-3} + A^2 - I$

(D) $A^n = A^{n-3} - A^2 - I$

where I is the identity matrix of order 3.

019. $\displaystyle \lim_{x \to 0} x \sin \frac{1}{x} =$

(A) 0　　　　　(B) 1

(C) ∞　　　　(D) $-\infty$

020. If $f(x) = \begin{cases} \dfrac{x\left(e^{\frac{1}{x}} - e^{\frac{1}{x}}\right)}{\left(e^{\frac{1}{x}} + e^{\frac{1}{x}}\right)}, & x \neq 0 \\ 0, & x = 0 \end{cases}$, then

(A) f is continuous and derivable at $x=0$

(B) f is continuous but not derivable at $x=0$

(C) f is discontinuous at $x = 0$

(D) f is derivable everywhere.

021. The sum of the serie

$1 - \dfrac{1}{2^2} + \dfrac{1}{3^2} - \dfrac{1}{4^2} + ...,$ is equal to

(A) $\dfrac{\pi^2}{4}$　　　　(B) $\dfrac{\pi^2}{6}$

(C) $\dfrac{\pi^2}{8}$　　　　(D) $\dfrac{\pi^2}{12}$

022. The general solution of the partial differential equation

$\left(\dfrac{y-z}{yz}\right)\dfrac{\partial z}{\partial x} + \left(\dfrac{z-x}{zx}\right)\dfrac{\partial z}{\partial y} = \dfrac{x-y}{xy}$, is

(A) $\phi(xyz, x^2 + y^2 + z^2) = 0$

(B) $\phi(xyz, xy + yz + zx) = 0$

(C) $\phi(xyz, x + y + z) = 0$

(D) $\phi(xyz, x^2y + y^2z + z^2x) = 0$

023. A unit vector normal to the surface $x^3 + y^3 + 3xyz = 3$ at the point (1,2,-1) is

(A) $\dfrac{\hat{i} + 3\hat{j} + 2\hat{k}}{\sqrt{14}}$　　(B) $\dfrac{-\hat{i} + 3\hat{j} + 2\hat{k}}{\sqrt{14}}$

(C) $\dfrac{\hat{i} + 2\hat{j} + 3\hat{k}}{\sqrt{14}}$　　(D) $\dfrac{-\hat{i} + 2\hat{j} + 3\hat{k}}{\sqrt{14}}$

024. The vector field defined by

$$\vec{F} = (x + 2y + az)\hat{i} + (bx - 3y - z)\hat{j} + (4x + cy + 2z)\hat{k}$$

is irrotational, if

(A) $a=4, b=2, c=-1$

(B) $a=4, b=-2, c=1$

(C) $a=1, b=2, c=4$

(D) $a=-1, b=4, c=2$.

025. The value of $\oint_c \left(x^2 + xy\right)dx + \left(x^2 + y^2\right)dy$

where C is the square formed by the lines

$y = \pm 1, x = \pm 1$, is equal to

(A) 2π (B) 2

(C) 1   (D) 0

026. The only solution of the differential equation

$x\dfrac{dy}{dx} - \dfrac{1}{2}y = x + 1$ for which x and y can

attain the value unity is given by

(A) $y = 2x - \sqrt{x} + 2$

(B) $y = 2x + \sqrt{x} + 2$

(C) $y = 2x - \sqrt{x} - 2$

(D) $y = 2x + \sqrt{x} - 1$

027. The Laplace transform of $e^x x^{\frac{1}{2}}$ is

(A) $\dfrac{x}{\sqrt{s-1}}$ (B) $\dfrac{\sqrt{\pi}}{\sqrt{s-1}}$

(C) $\dfrac{\sqrt{\pi}}{\sqrt{s+1}}$ (D) $\dfrac{\pi}{\sqrt{s+1}}$

028. A die is tossed thrice. A success is getting *1* or *6* on a toss. Then the mean of the number of success is

(A) $\dfrac{1}{2}$

(B) $\dfrac{1}{3}$

(C) $\dfrac{2}{3}$

(D) 1

029. A manufacturer knows that the condensers he makes contain on an average 1% of defectives. He packs them in boxes of 100. The probability that a box picked at random will contain 4 or more faulty condensers is

(A) $1 - \dfrac{8}{3e}$

(B) $1 - \dfrac{3}{8e}$

(C) $1 - \dfrac{4}{3e}$

(D) $1 - \dfrac{3}{4e}$

030. The order of convergence of Newton Raphson method is
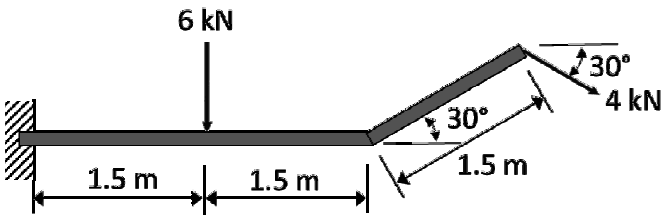
(A) 0

(B) 1

(C) 2

(D) 3

Section - B : Mechanical Engineering

031. For the cantilever beam shown in the figure, the moment at the fixed support is

(A) 0 kN.m   (B) 11.6 kN.m

(C) 17.6 kN.m   (D) 20.2 kN.m

032. Two particles A and B moving in a straight line have velocities of approach as v'_A and v'_B, after collision their separation velocities are v'_A and v'_B. The coefficient of restitution e is given by

(A) $e = \dfrac{v'_A - v'_B}{v_A - v_B}$

(B) $e = \dfrac{v'_B - v'_A}{v_A - v_B}$

(C) $e = \dfrac{v_A - v_B}{v'_A - v'_B}$

(D) None of the above.

033. Consider a square with each side of length 3 cm. The moment of inertia of the square area with respect to a line along one of its sides is

(A) $\dfrac{27}{4}$ cm^4

(B) 27 cm^4

(C) $\dfrac{81}{4}$ cm^4

(D) 81 cm^4

034. For a ladder resting on the ground and leaning against a smooth vertical wall, the direction of friction force is

(A) Towards the ground at the lower end

(B) Away from the ground at the lower end

(C) Towards the wall at the lower end

(D) Away from the wall at the lower end

035. A spring of stiffness K is broken into two halves of equal lengths. What is the effective stiffness when the two half springs are arranged in parallel?

(A) K/4   (B) K/2

(C) 2K   (D) 4K

036. A rim-type flywheel of mean radius 0.5 m stores kinetic energy of 40 kJ when rotating at a specific speed. What is the kinetic energy stored if the mean radius is decreased to 0.25 m keeping the mass and speed constant?

(A) 10 kJ   (B) 20 kJ

(C) 80 kJ   (D) 120 kJ

037. A simply supported beam of length 2 m is subjected to a uniformly distributed load of 10 kN/m over the entire length of the beam. The maximum bending moment in the beam is

(A) 5 kN.m

(B) 10 kN.m

(C) 20 kN.m

(D) 40 kN.m

038. A rotor rotating about its axis has an unbalanced force *F* due to an eccentric mass. What is the unbalanced force if both the eccentric mass and rotating speeds are doubled?

(A) *F* (B) *2F*

(C) *4F* (D) *8F*

039. For a four-bar linkage, let L and S be the lengths of the longest and shortest links respectively, and P and R are the lengths of the other two links. All inversions will result in double-rocker mechanism if

(A) L+S < P+Q

(B) L+S = P+Q

(C) L+S > P+Q

(D) L+P = S+Q

040. The longitudinal stress is 100 MPa in a long thin cylindrical vessel closed at both ends that is subjected to internal pressure. The corresponding hoop stress in the vessel is

(A) 50 MPa (B) 100 MPa

(C) 200 MPa (D) 150 MPa

041. ω is the natural frequency of lateral vibrations for mass M at the end of a cantilever beam of negligible mass and length L as shown in the figure. The natural frequency when both mass M and length L are doubled is

(A) $\omega/4$ (B) $\omega/2$

(C) 2ω (D) 4ω

042. In which of the following gears, the axial thrust is minimum?

(A) Bevel gears

(B) Helical gears

(C) Herringbone gears

(D) Worm gears

043. Lewis equation in gears is used to estimate

(A) Bending stress

(B) Contact stress

(C) Endurance stress

(D) Impact stress

044. The von Mises stress at a point in a material is proportional to the

(A) Dilatational strain energy

(B) Distortional energy

(C) Strain energy

(D) Plastic strain energy

045. Which of the following failure criteria does not predict failure under multiple cyclic loads?

(A) Gerber line

(B) Modified Goodman line

(C) Langer line

(D) Soderberg line

046. A simple pendulum of length L and end mass M has a time period T. The time period when both mass M and length L are doubled is

(A) *T*

(B) $\sqrt{2}\,T$

(C) *2T*

(D) $T/\sqrt{2}$

047. Which of the following mechanical properties of a material is determined by Charpy test?
(A) Resilience
(B) Yield stress
(C) Toughness
(D) Endurance limit

048. For an element in plane stress, if the larger of the principal stresses is 3 times that of the smaller one, the value of the maximum shear stress is equal to
(A) The smaller principal stress
(B) The larger principal stress
(C) Half of the higher principal stress
(D) Sum of the two principal stress

049. The pressure angle of a cam can be reduced by
(A) Increasing the size of the cam
(B) Decreasing the size of the cam
(C) Increasing the speed of the cam
(D) Decreasing the speed of the cam

050. For V belt drives, the groove angle of a sheave is _____ the belt-section angle.
(A) smaller than
(B) bigger than
(C) same as
(D) independent of

051. The high-cycle fatigue is concerned with failure corresponding to stress cycles exceeding
(A) 1000 cycles
(B) 10,000 cycles
(C) 100,000 cycles
(D) 1,000,000 cycles

052. The yield stress of a material in uniaxial tension is 240 MPa. The yield stress in pure shear, according to Von-Mises yield criterion and Tresca yield criterion, respectively, is
(A) 138.6 MPa and 120 MPa
(B) 277.2 MPa and 120 MPa
(C) 120 MPa and 138.6 MPa
(D) 120 MPa and 277.2 MPa

053. In steady state forced vibrations, the amplitude of vibrations at resonance is
(A) Directly proportional to the damping coefficient
(B) Directly proportional to the square of the damping coefficient
(C) Inversely proportional to the damping coefficient
(D) Inversely proportional to the square of the damping coefficient

054. Ultrasonic machining process removes material from the workpiece by
(A) High frequency sound waves
(B) High frequency vibrations between tool and work piece
(C) High frequency eddy currents
(D) High frequency hammering action of the abrasive particles onto the work material

055. To produce a large non axi-symmetric casting which type of pattern is normally preferred?
(A) Split pattern
(B) Cope and drag pattern
(C) Sweep pattern
(D) Skeleton pattern

056. Investment casting is suitable for
(A) very small sized products
(B) large and medium sized products
(C) large sized products Sweep pattern
(D) both large and small sized products

057. The welding processes which uses flux in the form of granules is
(A) Spot welding
(B) Submerged arc welding
(C) TIG welding
(D) MIG welding

058. In rolling, neutral point is the location where
(A) work velocity is less than roll velocity
(B) work velocity is equal to roll velocity
(C) work velocity is more than roll velocity
(D) work velocity and roll velocity becomes independent of each other

059. Gear cutting on a milling machine using an involute profile cutter is an example of
(A) gear shaping process
(B) gear hobbing process
(C) gear generation process
(D) gear forming process

060. High strength superalloys can be cold extruded by
(A) Impact extrusion process
(B) Backward extrusion process
(C) Forward extrusion process
(D) Hydrostatic extrusion process

061. Which of the following can be classified as forging operation?
(A) Thread rolling
(B) Mannesmann Process
(C) Coining
(D) Thread chasing

062. Earring is a defect associated mostly with
(A) Rolling process
(B) Forging process
(C) Extrusion process
(D) Deep Drawing process

063. Which of the following engineering materials is the most suitable candidate for hot chamber die casting?
(A) zinc
(B) low carbon steel
(C) titanium
(D) copper

064. Match the correct pair between List A and the List B

List A (Casting Defect)	List B (Possible Cause)
a. Penetration	1. hydrogen inclusion
b. Misrun	2. poor collapsibility of the mould
c. Hot tears	3. high fluidity of liquid metal
d. Pin holes	4. slow pouring rate

(A) 1-b-2-a-3-c-4-d
(B) 1-a-2-d-3-c-4-b
(C) 1-c-2-b-3-a-4-b
(D) 1-d-2-c-3-a-4-b

065. The machining chips will be always discontinuous type and irregular in size and shape if the work material being machined is

(A) mild steel

(B) titanium alloy

(C) stainless steel

(D) grey cast iron

066. As tool and work are not in contact in EDM process

(A) no relative motion occurs between them

(B) no wear of tool occurs

(C) no power is consumed during metal cutting

(D) no force between tool and work occurs

067. Brazing and Soldering are

(A) plastic joining methods

(B) homogeneous joining methods

(C) autogenous joining methods

(D) heterogeneous joining methods

068. Chills are used in casting moulds to

(A) achieve directional solidification

(B) reduce roughness of the cast surface

(C) increase the solidification time

(D) store the excess molten metal

069. Circular blanks of 10 *mm* diameter are punched from an aluminum sheet of 2 *mm* thickness. The shear strength of aluminum is 80 *MPa*. The minimum punching force required in *kN* is

(A) 2.57

(B) 3.29

(C) 5.03

(D) 6.33

070. In a rolling process, the state of stress of the material undergoing deformation is

(A) Pure compression

(B) Pure shear

(C) Both compression and shear

(D) Both tension and shear

071. A solid cylinder of diameter 100 *mm* and height 50 *mm* is forged between two frictionless flat dies to a height of 25 *mm*. The percentage change in diameter is

(A) 0   (B) 2.07

(C) 20.07   (D) 41.4

072. In a CAD package, mirror image of a 2D point (5, 10) is to be obtained about a line which passes through the origin and makes an angle of 45° counter clockwise with the X-axis. The coordinates of the transformed point will be

(A) (7.5, 5)

(B) (10, 5)

(C) (7.5, – 5)

(D) (10, – 5)

073. Cylindrical pins of $25^{0.02}_{0.01}$ mm. diameter are electroplated in a shop. Thickness of the plating is 30^{+2}_{-2} micron. Neglecting gage tolerances, the size of the GO gage in mm to inspect the plated components is

(A) 25.042

(B) 25.052

(C) 25.074

(D) 25.084

074. The crystal structure of austenite is
- (A) Body Centered Cubic
- (B) Face Centered Cubic
- (C) Hexagonal closed packed
- (D) Body centered tetragonal

075. Vehicle manufacturing assembly line is an example of
- (A) product layout
- (B) process layout
- (C) manual layout
- (D) fixed layout

076. In PERT Analysis a critical activity has
- (A) Maximum float
- (B) Zero float
- (C) Maximum cost
- (D) Minimum cost

077. Market demand for springs is 8,00,000 per annum. A company purchases these springs in lots and sells them. The cost of making a purchase order is Rs.1200. The cost of storage of springs is Rs.120 per stored piece per annum. The economic order quantity is
- (A) 400
- (B) 800
- (C) 4000
- (D) 8000

078. The hydraulic diameter (in cm) of a square pipe of side 3 cm is
- (A) 16/3
- (B) 3/16
- (C) 3
- (D) 1/3

079. Bernoulli's equation given by $P/\rho + V^2/2 + gz =$ constant is applicable along a streamline for
- (A) Steady, frictionless, incompressible flow without shaft work or heat transfer
- (B) Steady or unsteady but frictionless, incompressible flow without shaft work or heat transfer
- (C) Viscous or inviscid but steady, incompressible flow without shaft work or heat transfer
- (D) Compressible or incompressible but steady, frictionless flow without shaft work or heat transfer

080. Consider a car moving steadily on a road. The fuel spent in the car engine is primarily to overcome the
- (A) Lift force
- (B) Drag force
- (C) Buoyancy
- (D) Friction between tyres and the road

081. Consider water flowing steadily through a uniform area duct. The total momentum of the fluid at a cross-section 1 m after the entrance of the duct will be
- (A) Lower than the fluid momentum at the entrance of the duct
- (B) Same as the fluid momentum at the entrance of the duct
- (C) Higher than the fluid momentum at the entrance of the duct
- (D) Data provided is insufficient

082. If velocity **V** is given as **V** = y**i**, where **i**, **j**, **k** are unit vectors of x, y, z axes in a Cartesian coordinate system respectively, how is the vorticity vector (ω = curl (**V**)) aligned?

(A) Parallel to xy plane

(B) Perpendicular to xy plane

(C) Perpendicular to yz plane

(D) Perpendicular to xz plane

083. A viscous fluid flows between two infinite parallel plates parallel to the x-axis with lower and upper plates at y = 0 and y = h, respectively. The top plate moves at a speed U and the bottom plate moves at a speed U/2 along the x-direction. No external pressure drop is applied. The velocity profile for this flow is given by:

(A) $u(y) = Uy/h + U/2$

(B) $u(y) = U(1 - y/h)$

(C) $u(y) = \frac{1}{2}U(1 + y/h)$

(D) $u(y) = U\frac{y}{h}\left(1 - \frac{y}{h}\right)$

084. Consider a laminar boundary layer over a flat plate. The boundary layer thickness at a particular location is δ_1. If the free stream velocity is doubled, the boundary layer thickness at the same location changes to δ_2 Assuming that the boundary layer remains laminar upon increasing the free-stream velocity, the ratio δ_2 / δ_1 is:

(A) 2

(B) 0.5

(C) 1.4

(D) 0.7

085. Which one of the following statement is correct?

(A) Evaporative cooling is a cooling and humidification process

(B) Evaporative cooling is a cooling and dehumidification process

(C) Sensible cooling is a cooling and dehumidification process

(D) Sensible cooling is a cooling and humidification process

086. Which of the following statements is true for an ideal superheat Rankine Cycle.

(A) The increase in pressure of heat addition process at constant maximum temperature leads to increase in quality of steam at turbine exit.

(B) The increase in pressure of heat addition process at constant maximum temperature does not affect the quality of steam at turbine exit.

(C) The increase in pressure of heat addition process at constant maximum temperature leads to decrease in efficiency of the cycle

(D) The increase in pressure of heat addition process at constant maximum temperature leads to decrease in quality of steam at turbine exit

087. For liquid metals, the thermal entry length is _____ than for oils in a pipe of a given diameter, if the velocity is fully developed for both at inlet.

Fill up the blank from one of the following choices.

(A) slightly longer

(B) much longer

(C) slightly shorter

(D) much shorter

088. Nusselt number is
   (A) a function of Reynolds number and Prandtl number for all kinds of flows
   (B) always constant for a given type of flow configuration
   (C) the ratio of heat transfer with flow to that without flow for the same configuration
   (D) a function of only Reynolds number

089. Which of the following statements is always TRUE:
   (A) Fin efficiency as well as fin effectiveness are numbers less than unity
   (B) Fin efficiency as well as fin effectiveness are numbers greater than unity
   (C) Fin efficiency is always less than unity, while fin effectiveness is always higher than unity
   (D) Fin efficiency is always greater than unity, while fin effectiveness is always less than unity

090. Which of these statements is CORRECT: Lumped parameter analysis in transient conduction is valid:
   (A) ONLY when the Biot number is zero
   (B) ONLY when the Biot number is infinite
   (C) ONLY when Biot number is much less than unity
   (D) ONLY when Biot number is much greater than unity

091. In a boiling heat exchanger, NTU is
   (A) related to the material properties of the heat exchanger tubes
   (B) related to the thermal conductivity of the hot and cold fluids
   (C) infinite or zero: cannot have values in between
   (D) related to the heat capacity of the non-boiling fluid, areas and overall thermal resistance

092. The view factor F_{1-2} (sphere to an infinite plane) for the following case:
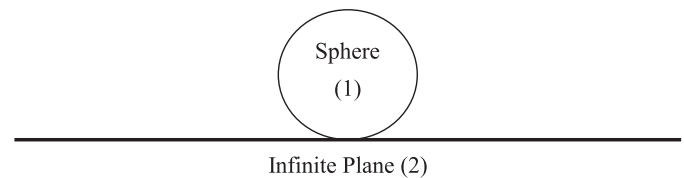
   (A) 1   (B) 0
   (C) 0.5   (D) ∞

093. At steady state heat conduction, temperature profiles for infinite slabs made of three different materials A, B and C are shown in figure below, for the same boundary temperatures T_L and T_R. Which of the following statements given below is a CORRECT description of these curves?
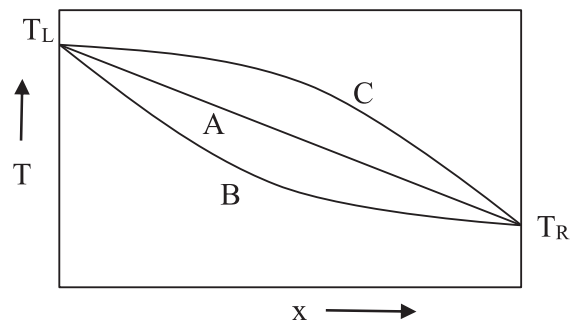
   (A) All three curves represent constant thermal conductivity k with temperature
   (B) Material A has constant k, B has k increasing with temperature, C has k decreasing with increase in temperature
   (C) Material A has constant k, B has k decreasing with increase in temperature, C has k increasing with temperature
   (D) Curve A alone is correct, the other two cannot be correct in the absence of heat generation in the slab

094. A brick wall of thickness 0.18 m and conductivity $k = 0.9$ W/mK separates the warm air in a room from the cold ambient air. On a particular winter day, the outside air temperature is $-5°C$ and the room needs to be maintained at $30°C$. The heat transfer coefficient associated with outside air is 20 W/m^{2}K. Neglect the convective resistance of the air inside the room. The outside temperature (in °C) of the wall will be

(A) 2   (B) -5

(C) 25   (D) 12.5

095. Calculate approximate temperature (in °C) of the steam described in following table:

Pressure, Mpa	Enthalpy, kJ/kg	Entropy kJ/kg.K
10	2066.5	4.4870
10	2092.8	4.5321

(A) 410   (B) 110

(C) 310   (D) 210

096. A rigid container of volume 0.5 m^3 contains 1.0 kg of water at 120 °C ($v_f = 0.00106$ m^3/kg, $v_g = 0.8908$ m^3/kg). The state of water is

(A) compressed liquid

(B) saturated liquid

(C) a mixture of saturated liquid and saturated vapor

(D) superheated vapour

097. Consider a gas mixture that consists of 2 kg of O_2, 4 kg of N_2, and 10 kg of CH_4. If the Universal gas constant is 8.314 kJ/mol-K, the characteristic gas constant of the mixture in kJ/kg-K is

(A) 0.4315   (B) 0.5196

(C) 39.42   (D) 2.32

098. One kg of water at 80°C are mixed adiabatically with 1 kg of water at 30°C in a constant pressure process of 1 atmosphere. The increase in the entropy (in kJ/K) of total mass of water due to the mixing process will be (Take c_p of water $= 4$ kJ/kg-K)

(A) 0.0233   (B) 0.6109

(C) 0.9258   (D) 0

099. At the end of a throttling process, which of these properties remains equal to that at inlet conditions?

(A) Specific volume

(B) Temperature

(C) Enthalpy

(D) Entropy

100. Which of the following is correct for an irreversible heat engine? (Symbols have usual meaning)

(A) $\oint \delta Q > 0 \ \& \ \oint \dfrac{\delta Q}{T} < 0$

(B) $\oint \delta Q = 0 \ \& \ \oint \dfrac{\delta Q}{T} = 0$

(C) $\oint \delta Q > 0 \ \& \ \oint \dfrac{\delta Q}{T} > 0$

(D) $\oint \delta Q < 0 \ \& \ \oint \dfrac{\delta Q}{T} < 0$

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