

PGCET-2023

Seat No. _____

SUB: Mechatronics Engineering

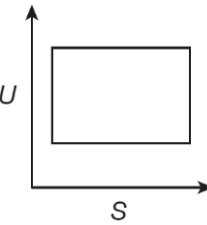
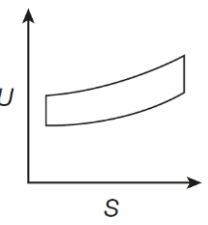
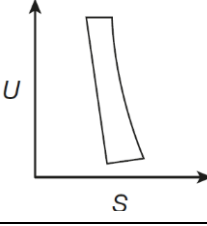
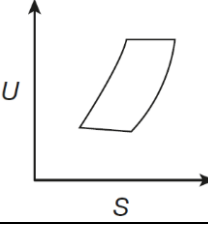
Time: 1 Hour 30 minutes

Instructions:

1. Ensure that all pages are printed.
2. Use Black ball pen only
3. Change in option is not allowed
4. There is no negative marking
5. Use of non-programmable scientific calculator is allowed

1	In the atoms of semiconducting materials like silicon and germanium the outermost orbit has			
	A	1 electron	B	2 electrons
	C	8 electrons	D	4 electrons
2	The direction of the induced EMF in the coil sides of a coil rotating in a magnetic field can be determined by applying			
	A	Fleming's left-hand rule	B	Right-hand-grip rule
	C	Fleming's-right-hand rule	D	Cork screw rule
3	The number of electrons per Coulomb is equal to			
	A	1.602×10^{-19}	B	6.28×10^{18}
	C	1.602×10^{18}	D	6.28×10^{-19}
4	Three resistances of equal value, R are connected such that they form a triangle having terminals A, B, and C. The equivalent value of the resistances across terminal A and B is equal to			
	A	R/3	B	3 R /2
	C	2 R /3	D	3 R
5	In a purely inductive circuit			
	A	Current lags the voltage by 90°	B	Current leads the voltage by 90°
	C	Voltage lags the current by 90°	D	Current lags the voltage by 180°
6	A voltmeter must have very high internal resistance so that			
	A	Its accuracy is high	B	Its resolution is high
	C	It draws a very small amount of current	D	It creates a high loading effect on the circuit
7	MOSFET stands for			
	A	Metal oxide silicon field effect transistor	B	Metal oxide semiconductor field excited Transistor
	C	Metal oxide silicon field excited transistor	D	Metal oxide semiconductor field effect transistor
8	Transistor can be used as an amplifier when it is operated			
	A	In the saturation region	B	In the cut-off region
	C	In the active region	D	In both saturation and cut-off regions

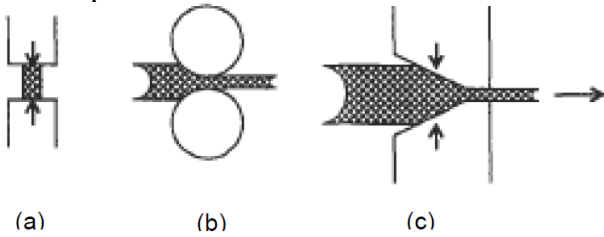
9	Ripple factor for a half-wave and full-wave rectifier circuit, respectively are			
	A	0.48 and 1.21	B	0.48 and 0.121
	C	4.8 and 1.21	D	8.21 and 0.48.
10	Which of the following gates is represented by the Boolean expression: $A + B + C + D = Y$			
	A	4-input AND gate	B	4-input OR gate
	C	4-input NAND gate	D	4-input NOR gate
11	Microprocessors are			
	A	Small-scale integrated circuits (SSI)	B	Medium-scale integrated circuits (MSI)
	C	Large-scale integrated circuits (LSI)	D	Very-large scale integrated circuits (VLSI).
12	What is the largest integer number that a PLC counter function can reach if it uses 16 bit register			
	A	32,768	B	65,535
	C	65,536	D	32,767
13	The transfer function is applicable to which of the following?			
	A	Linear and time-invariant systems	B	Linear and time-variant systems
	C	Linear systems	D	Non-linear systems
14	If a process can be stopped at any stage and reversed so that the system and surroundings are exactly restored to their initial states, it is known as			
	A	Adiabatic process	B	Isothermal process
	C	Frictionless process	D	Ideal process
15	The entropy may be expressed as a function of			
	A	Temperature and volume	B	Pressure and temperature
	C	Heat and work	D	All of the above
16	The law of thermodynamics, which states that heat and work are mutually convertible is known as			
	A	Zeroth law of thermodynamics	B	Second law of thermodynamics
	C	First law of thermodynamics	D	Third law of thermodynamics
17	With increase in pressure the saturated temperature			
	A	Increases	B	Decreases
	C	Remains constant	D	Cannot be predicted
18	Bomb calorimeter is used to determine			
	A	Higher calorific value at constant volume	B	Higher calorific value at constant pressure
	C	Lower calorific value at constant volume	D	Lower calorific value at constant pressure

19	Economiser is generally placed between			
	A	Air-preheater and chimney	B	Last superheater/reheater and air-preheater
	C	Electrostatic precipitators	D	Induced draft fan and forced draft fan
20	An Otto cycle on internal energy (U) and entropy (s) diagram is shown in:			
	A		B	
	C		D	
21	Which one of the following events would reduce the volumetric efficiency of a vertical compression ignition engine?			
	A	Inlet valve closing after bottom head centre	B	Inlet valve closing before bottom dead centre
	C	Inlet valve opening before top dead centre	D	Exhaust valve closing after top dead centre
22	For the same maximum pressure and temperature			
	A	Otto cycle is more efficient than diesel cycle	B	Dual cycle is more efficient than Otto and diesel cycles
	C	Diesel cycle is more efficient than Otto cycle	D	Dual cycle is less efficient than Otto and diesel Cycles
23	Which one of the following statements is correct? In reciprocating compressors, one should aim at compressing the air			
	A	Adiabatically	B	Isentropically
	C	Isothermally	D	Polytropically
24	What does application of centrifugal air compressors lead to?			
	A	Large frontal area of aircraft	B	Higher flow rate through the engine
	C	Higher aircraft speed	D	Lower frontal area of the aircraft
25	One tonne of refrigeration is equal to			
	A	211 kJ/min	B	220 kJ/min
	C	420 kJ/min	D	620 kJ/min

26	Reversed Carnot cycle comprises			
	A	Two isentropic processes and two adiabatic Processes	B	Two isentropic processes and two constant Pressure processes
	C	Two isentropic processes and two constant Volume processes	D	Two isentropic processes and two isothermal Processes
27	A lead screw with nut in lathe is example of			
	A	Sliding pair	B	Screw pair
	C	Higher pair	D	Rolling pair
28	The Coriolis acceleration component is taken into account in which of the following mechanisms?			
	A	Crank and slider mechanisms	B	Scotch Yoke
	C	Four bar mechanisms	D	Quick return mechanisms
29	The velocity ratio of two pulleys in open belt or cross belt is			
	A	Directly proportional to their diameters	B	Directly proportional to square of their diameters
	C	Indirectly proportional to their diameters	D	Indirectly proportional to square of their diameters
30	Crowning of the pulley is done to			
	A	Increase the tightness of the belt on pulleys	B	Prevent belt running off the pulley
	C	Increase the torque transmission	D	Improve the shape and strength of the pulley
31	The size of the gears is usually specified by			
	A	Circular pitch	B	Outside diameter
	C	Pitch circle diameter	D	Inside diameter
32	The contact ratio of the belt is always			
	A	More than one	B	One
	C	Less than one	D	Two
33	A gear train in which the axes of gears have motion are called			
	A	Revert gear train	B	Compound gear train
	C	Simple gear train	D	Epicyclic gear train
34	The basic series of preferred numbers are			
	A	R5, R10, R20, R40 and R80	B	R10, R20, R30, R40 and R50
	C	R5, R10, R15, R20 and R30	D	R5, R10, R20, R25 and R30
35	Ergonomics deals with			
	A	Design of controls	B	Design of displays
	C	Energy expenditure in hand and foot operations	D	All the three
36	Which of the following material has maximum strength			
	A	Grey cast iron	B	Plain carbon steel
	C	Alloy steel	D	Aluminium alloy

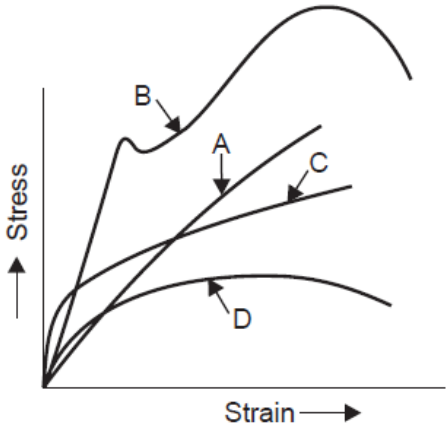
37	Mild steel contains			
	A	Less than 0.3 % carbon	B	0.3 to 0.5% carbon
	C	0.5 to 1.4% carbon	D	3 to 4 % carbon
38	Material used for machine tool beds is			
	A	Cast iron	B	Mild steel
	C	High carbon steel	D	Alloy steel
39	A cast iron designated by FG300 is			
	A	Grey cast iron with carbon content of 3%	B	Grey cast iron with ultimate tensile strength of 300 N/mm ²
	C	Grey cast iron with ultimate compressive strength of 300 N/mm ²	D	Grey cast iron with tensile yield strength of 300 N/mm ²
40	In forged components			
	A	Fiber lines are arranged in predetermined way	B	Fiber lines of rolled stock are broken
	C	There are no fiber lines	D	Fiber lines are scattered
41	According to Indian standard, 50 H8-g7 means			
	A	Tolerance grade for hole is 8 and for shaft is 7	B	Tolerance grade for shaft is 8 and for hole is 7
	C	Designation of fit on shaft basis system	D	None of the above
42	In interference fit,			
	A	Tolerance zone of the hole and shaft overlap	B	Tolerance zone of hole is completely below that of shaft
	C	Tolerance zone of hole is entirely above that of shaft	D	None of the above
43	Hot working of metals carried out			
	A	At the recrystallization temperature	B	Below the recrystallization temperature
	C	Above the recrystallization temperature	D	At higher temperature
44	Cold working			
	A	Increases toughness and ductility	B	Reduce residual stresses
	C	Increases hardness and strength	D	Produce favorable pattern of fiber lines
45	The modulus of elasticity of carbon steel is			
	A	207 000 N/mm ²	B	100 000 N/mm ²
	C	50 000 N/mm ²	D	208 00 N/mm ²
46	When the diameter of the shaft is doubled, its torque transmission capacity will increase by			
	A	16 times	B	2 times
	C	4 times	D	8 times

47	When hole of diameter d is punched in a plate of thickness t , the force required to punch the hole is given by, where S_{us} is ultimate shear strength of plate material			
	A	$\pi d^2 t S_{us}$	B	$\pi d t S_{us}$
	C	$\pi d^2 t S_{us}/4$	D	$\pi d^2 S_{us}/4$
48	The maximum bending stress in a curved beam, having symmetrical cross section, always occurs at			
	A	Neutral axial	B	Outer fiber
	C	Centroidal axis	D	Inner fiber
49	For maximum shear stress theory, the shape of the region of safety on σ_1, σ_2 co-ordinate system is			
	A	Square	B	Hexagon
	C	Ellipse	D	Circle
50	Distortion energy theory of failure is applicable to			
	A	Components made of plain carbon steel	B	Components made of composites
	C	Components made of cast iron	D	Components mad of non-metals
51	Stress concentration occurs due to			
	A	Blow holes	B	Keyways and splines
	C	Machining scratches	D	Anyone of the above
52	Fatigue failure results due to fluctuate stresses when the stress magnitude is			
	A	More than ultimate tensile strength	B	More than yield strength
	C	Lower than yield strength	D	None of the above
53	While designing a flange coupling, care is taken so that			
	A	Shaft is the weakest component	B	Bolts are the weakest components
	C	Key is the weakest component	D	The flange is the weakest component

54	In the figure different metal forming processes are shown schematically. Which option best describe these processes?			
	 <div style="display: flex; justify-content: space-around; margin-top: 10px;"> (a) (b) (c) </div>			
	A	Drawing, forging, rolling	B	Forging, drawing, rolling
	C	Rolling, drawing, forging	D	Forging, rolling, drawing
55	Which one of the following arcs welding processes uses a non consumable electrode?			
	A	Flux Cored Arc Welding (FCAW)	B	Gas Metal Arc Welding (GMAW)
	C	Gas Tungsten Arc Welding (GTAW)	D	Shielded Metal Arc Welding (SMAW)
56	A moving mandrel is used in			
	A	Tube drawing	B	Forging
	C	Wire drawing	D	Metal cutting
57	Which of the following qualifies as a precision-casting process?			
	A	Ingot casting	B	Investment casting
	C	Sand casting	D	Shell molding
58	Which of the following casting process is not a permanent mold operation?			
	A	Centrifugal casting	B	Die casting
	C	Sand casting	D	Slush casting
59	Which of the following are bulk deformation processes : (a) bending, (b) deep drawing, (c) extrusion, (d) forging, (e) rolling, and (f) shearing?			
	A	a, b, c	B	b, c, f
	C	c, d, e	D	a, d, f
60	The cutting force in a sheet-metal blanking operation depends on which mechanical property of the metal?			
	A	Compressive stress	B	Modulus of elasticity
	C	Shear strength	D	Strain rate

61	Which of the following manufacturing processes are classified as material removal process?			
	A	Casting	B	Drawing
	C	Extrusion	D	Grinding
62	Which one of the four types of chip would be expected in a turning operation conducted at low cutting speed on a brittle work material ?			
	A	Continuous	B	Continuous with built-up edge
	C	Discontinuous	D	Serrated
63	According to the Merchant equation, an increase in rake angle would have which of the following result, all other factors remaining the same ?			
	A	Decrease in friction angle	B	Decrease in power requirements
	C	Decrease in shear plane angle	D	Increase in cutting temperature
64	End milling is most similar to which one of the following?			
	A	Face milling	B	Peripheral milling
	C	Plain milling	D	Slab milling
65	Which of the following are the two main functions of a cutting fluid in machining ? (a) improve surface finish on the workpiece, (b) reduce forces and power, (c) reduce friction at the tool-chip interface, (d) remove heat from the process, and (e) wash away chips?			
	A	a, b	B	b, f
	C	c, d	D	a, e
66	The region throughout which a robot arm can accomplish task is called its:			
	A	Coordinate geometry	B	Reference axis
	C	Reference frame	D	Work envelope
67	Which of the following configuration has three mutually perpendicular axis?			
	A	Cartesian coordinate configuration	B	Cylindrical configuration
	C	Spherical configuration	D	SCARA
68	What is the source of robot inaccuracy?			
	A	Gear backlash	B	Active joint error
	C	Kinematic errors and non kinematic errors	D	All of the above

69	The transform which possesses the ‘multi-resolution’ property is			
	A	Fourier transform	B	short-time Fourier transform
	C	cosine transform	D	wavelet transform
70	For an eight-bit image $x[m, n]$, the transformation $y[m, n] = 255 - x[m, n]$ will yield a/an			
	A	dark image	B	bright image
	C	negative of the input image	D	output image same as the input image
71	Comparing geometrical zonal coding with threshold coding, for the same number of transmitted samples, which of the following is not correct?			
	A	Threshold coding has more distortions.	B	Threshold coding mask gives a better choice of transmission samples.
	C	Threshold coding needs more rates	D	In threshold coding, the addresses of the transmitted samples have to be coded for every image block.
72	In a CAD package, mirror image of a 2D point P (5, 10) is to be obtained about a line which passes through the origin and makes an angle of 45° counterclockwise 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)
73	The Assignment Problem is solved by			
	A	Simplex method	B	Hungarian method
	C	Vector method	D	Graphical method
74	In graphical solution of solving Linear Programming problem to convert inequalities into equations, we,			
	A	Use Slack variables,	B	Use Surplus variables
	C	Use Artificial surplus variables	D	Simply assume them to be equations
75	When the total allocations in a transportation model of $m \times n$ size is not equals to $m + n - 1$ the situation is known as			
	A	Unbalanced situation	B	Tie situation
	C	Degeneracy	D	None of the above

76	Queuing models measure the effect of:			
	A	Random arrivals	B	Random service
	C	Effect of uncertainty on the behaviour of the queuing system	D	Length of queue
77	A cantilever of length (l) carries a load whose intensity varies uniformly from zero at the free end to w per unit length at the fixed end, the bending moment diagram will be a			
	A	Cubic curve	B	Parabolic curve
	C	Straight line curve	D	Combination of (a) and (b).
78	In a CNC program block, N002 G02 G91 X40 Z40..., G02 and G91 refer to			
	A	Circular interpolation in counterclockwise direction and incremental dimension	B	Circular interpolation in counterclockwise direction and absolute dimension
	C	Circular interpolation in clockwise direction and incremental dimension	D	Circular interpolation in clockwise direction and absolute dimension
79	The stress and strain curves for four different materials, <i>i.e.</i> , mild steel, cast iron, brass and cast aluminium are shown in Figure. The curve B is for			
				
	A	Mild steel	B	Cast iron
	C	Brass	D	Cast aluminium
80	In shaper the ram should move			
	A	Slower during return stroke	B	Faster during return stroke
	C	At the same speed during return stroke	D	All of above

81	$\lim_{x \rightarrow \frac{\pi}{2}} \frac{\sin(x \cos x)}{\cos(x \sin x)} = \dots\dots\dots$		
	A	$\frac{1}{\pi}$	B $\frac{2}{\pi}$
	C	does not exist	D $\frac{\pi}{2}$
82	Which of the following methods is not an iterative method for solving a system of simultaneous linear equations?		
	A	Gauss-Jacobi	B Gauss-Seidel
	C	relaxation	D Gauss elimination
83	If a vector field \vec{F} is conservative and curve C is closed then $\oint_C \vec{F} \cdot d\vec{r} = \dots\dots\dots$		
	A	non zero value	B $\vec{0}$
	C	0	D vector function
84	If $A = \begin{bmatrix} -1 & 1 & 2 \\ 0 & -2 & 1 \\ 0 & 0 & -3 \end{bmatrix}$ then the eigen values of A^2 are.....		
	A	1, 2, 3	B -1, -4, -9
	C	-1, -2, -3	D 1, 4, 9
85	Laplace transform of a constant function $f(t) = c$ is		
	A	$\frac{c}{s^2}$	B $c s$
	C	$\frac{c}{s}$	D c
86	The differential equation $(2x+1)^2 \frac{d^2y}{dx^2} - 2(2x+1) \frac{dy}{dx} - 12y = 6x$ can be solved by the substitution		
	A	$2x+1 = e^z$	B $x = e^z$
	C	$2z+1 = e^x$	D $2x+1 = y$
87	For what value of k the complex function $f(x+iy) = x^2 - y^2 + i kxy$ is analytic?		
	A	2	B 0
	C	-2	D none of these

88	$\oint_c \frac{1}{z} dz = \text{_____}$, where c is a unit circle in counterclockwise direction.		
	A	$-\pi i$	B $2\pi i$
	C	πi	D $-2\pi i$
89	$\int_0^{\infty} t^2 e^{-2t} dt$ equals		
	A	$\frac{1}{4}$	B $\frac{1}{2}$
	C	does not exist	D none of these
90	Which of the following matrix is in reduced row echelon form?		
	A	$\begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 0 & 0 \end{bmatrix}$	B $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{bmatrix}$
	C	$\begin{bmatrix} 1 & 2 & 4 \\ 0 & 1 & 5 \\ 0 & 0 & 0 \end{bmatrix}$	D $\begin{bmatrix} 1 & 4 & 5 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{bmatrix}$
91	The local maximum value of $f(x, y) = x + y + \frac{1}{x} + \frac{1}{y}$ is		
	A	-4	B both 4 and -4
	C	4	D does not exist
92	If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ then $\text{curl } \vec{r} = \dots$		
	A	$\vec{0}$	B \vec{r}
	C	0	D $x + y + z$
93	Which of the following methods does not require prior information about the approximate value?		
	A	bisection method	B false position method
	C	root squaring method	D Newton-Raphson method
94	Consider the probability function $p(x) = \frac{6 - x - 7 }{36}$ for $x = 2, 3, 4, \dots, 12$. What is $p(5 \leq x \leq 8)$?		
	A	$\frac{16}{36}$	B $\frac{6}{36}$
	C	$\frac{20}{36}$	D none of these
95	Which of the following methods is one of the predictor-corrector method to solve first order linear differential equation numerically?		
	A	Adams-Bashforth method	B Picard's method
	C	Runge-Kutta fourth order method	D Taylor's series method

96	Which of the following is a general solution of $\frac{d^2 y}{dx^2} + 3\frac{dy}{dx} - 10y = 0$?, where A and B are arbitrary constants.		
	A	$y = A e^{2x} + B e^{-5x}$	B $y = A e^{-2x} + B e^{-5x}$
	C	$y = A e^{-2x} + B e^{5x}$	D $y = A e^{2x} + B e^{5x}$
97	Statement: A bounded entire function is constant. This statement is of _____ theorem.		
	A	Cauchy residue	B Morera's
	C	Cauchy-Goursat	D Liouville's
98	The formula of numerical integration obtained from Newton-Cotes' quadrature formula by putting $n = 3$ is known as		
	A	Simpson's one-third rule	B Weddle's rule
	C	Simpson's three-eighth rule	D Gaussian quadrature formula
99	In which distribution mean, median and mode coincide?		
	A	Poisson	B exponential
	C	normal	D binomial
100	What is the formula for finding integral factor (IF) for $\frac{dy}{dx} + P(x)y = r(x)$?		
	A	$I.F. = e^{\int -P(x) dx}$	B $I.F. = e^{\int P(x) dx}$
	C	$I.F. = e^{\int -r(x) dx}$	D $I.F. = e^{\int r(x) dx}$