

# PGCET-2023

Seat No. \_\_\_\_\_

SUB: Mechanical 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	The spokes used in a flywheel increases its			
	A	Centripetal action	B	Angular momentum
	C	Angular velocity	D	Moment of inertia
2	The application of third type levers is found in			
	A	a pair of tongs	B	hand wheel of a punching press
	C	lever loaded safety valve	D	handle of a hand pump
3	The coefficient of friction depends on			
	A	area of contact	B	nature of surface
	C	shape of surfaces	D	strength of surfaces
4	The free body diagram of a body shows the body			
	A	With its surrounding and external forces acting on it.	B	Isolated from all external effects.
	C	Isolated from its surrounding.	D	Isolated from its surroundings and all external actions acting upon it.
5	A framed structure is perfect if it contains members equal to (Take $n$ = number of joint in frame)			
	A	$n-1$	B	$2n-3$
	C	$2n-1$	D	$n-2$
6	Centre of gravity of a solid cone lies on the axis at the height			
	A	one-fourth of the total height above base	B	one-third of the total height above base
	C	one-half of the total height above base	D	three-fourth of the total height above the base
7	Modulus of rigidity is defined as the ratio of			
	A	longitudinal stress and longitudinal strain	B	volumetric stress and volumetric strain
	C	shear stress and shear strain	D	lateral stress and lateral strain
8	The buckling load for a given material depends on			
	A	slenderness ratio and area of cross-section	B	slenderness ratio and modulus of elasticity
	C	Poisson's ratio and modulus of elasticity	D	slenderness ratio, area of cross-section and modulus of elasticity

9	If a part is constrained to move and heated, it will develop			
	A	principal stress	B	tensile stress
	C	compressive stress	D	shear stress
10	Which of the following materials is most elastic			
	A	rubber	B	steel
	C	plastic	D	brass
11	Subcritical flow always occurs when depth is			
	A	Less than normal depth	B	more than normal depth
	C	Less than critical depth	D	more than critical depth
12	A shaft carrying two rotors at ends will have following number of nodes			
	A	1	B	2
	C	3	D	0
13	Rated life of a ball bearing in relation to load (P) varies as			
	A	P	B	$P^2$
	C	$1 / P^2$	D	$1 / P^3$
14	Stub tooth in gears			
	A	Is standard tooth	B	Is longer than standard tooth
	C	Is shorter than standard tooth	D	Has special profile
15	Miter gears are			
	A	right angled bevel gears having same number of teeth	B	spur gears of equal diameter and pitch
	C	helical gears of same module	D	gears of different module
16	The type of tooth profile used for gears in watches and clocks is			
	A	Involute	B	cycloidal
	C	hypocycloid	D	Stub
17	Partial balancing in locomotive results in			
	A	Hammer blow, variation of tractive effort, swaying couple	B	Least wear
	C	Most smooth operation	D	Better performance of engine
18	Swaying couple results due to			
	A	Primary distributing force	B	secondary distributing force
	C	partial balancing	D	use of two cylinders
19	The maximum magnitude of the unbalanced force in line perpendicular to the line of stroke is known as			
	A	swaying couple	B	hammer couple
	C	variation in tractive effort	D	unbalanced force
20	An over damped system when disturbed from equilibrium position with an initial velocity will			
	A	Vibrate above equilibrium position	B	Immediately return to equilibrium position
	C	Not cross the equilibrium position	D	Return to equilibrium position after 1 to 2 oscillation

21	Guest's theory of failure is applicable for following type of materials			
	A	brittle	B	ductile
	C	elastic	D	plastic
22	Endurance limit or fatigue limit is the maximum stress that a member can withstand for a infinite number of load applications without failure when subjected to			
	A	Dynamic loading	B	static loading
	C	combine static and dynamic loading	D	completely reversed loading
23	When two springs are in series (having stiffness K), the equivalent stiffness will be			
	A	K	B	K/2
	C	2K	D	K/4
24	Factors of safety is the ratio of			
	A	Yield stress / working stress	B	tensile stress / working stress
	C	compressive stress / working stress	D	bearing stress / working stress
25	In order to facilitate the starting of the locomotive in any position, the cranks of locomotive with two cylinders are placed at following angle to each other			
	A	45°	B	90°
	C	135°	D	180°
26	Strain gauges are mainly used to measure			
	A	pressure	B	temperature
	C	velocity	D	Viscosity
27	The maximum propulsive efficiency of a turbo-jet engine is at speed of			
	A	1000 Km/hr	B	2000 Km/hr
	C	2400 Km/hr	D	3000 Km/hr
28	Which of the following boiler is best suited to meet the fluctuating demand of steam?			
	A	Locomotive boiler	B	Lancashire boiler
	C	Cornish boiler	D	Babcock and Wilcox boiler
29	Which of the following cycle is used as the basis for analysis of gas turbine operation			
	A	Carnot	B	Otto
	C	Diesel	D	Joule
30	Fire hose nozzle is generally made of			
	A	divergent shape	B	convergent shape
	C	cylindrical shape	D	parabolic shape
31	Gibbs phase rule is given by			
	A	$F=C+P$	B	$F=C+P-2$
	C	$F=C-P-2$	D	$F=C-P+2$
32	Martensite is a super saturated solution of carbon in			
	A	alpha iron	B	beta iron
	C	gamma iron	D	delta iron
33	Cores are used to			
	A	make desired recess in castings	B	strengthen moulding sand
	C	support loose pieces	D	remove pattern easily

34	Which one of following material require the largest size of riser for the same size of casting?			
	A	Aluminium	B	cast iron
	C	steel	D	copper
35	Rain drops are spherical because of			
	A	viscosity	B	air resistance
	C	surface tension forces	D	atmospheric pressure
36	Geometric similarity between model and prototype means			
	A	The similarity of discharge	B	The similarity of linear dimension
	C	The similarity of motion	D	The similarity of forces
37	Inter cooling in gas turbines			
	A	Decreases net output but increases thermal efficiency.	B	Increases net output but decreases thermal efficiency.
	C	Decreases both net output and thermal efficiency.	D	Increases both net output and thermal efficiency.
38	In a solar pond, solar energy is stored as			
	A	Thermal energy	B	Electrical energy
	C	Chemical energy	D	Atomic energy
39	The primary source behind wind energy is			
	A	Electrical energy	B	Tidal energy
	C	Solar energy	D	Geothermal energy
40	Aero planes employ following type of compressor			
	A	Radial flow	B	Axial flow
	C	Centrifugal	D	Combination of above
41	Size of boiler tubes is specified by			
	A	mean diameter and thickness	B	inside diameter and thickness
	C	outside diameter and thickness	D	outside diameter alone
42	Steam coming out of whistle of pressure cooker			
	A	Dry saturated vapour	B	wet vapour
	C	superheated vapour	D	ideal gas
43	Domestic refrigerator working on vapour compression cycle uses the following type of expansion device			
	A	electrically operated throttling valve	B	manually operated valve
	C	thermostatic valve	D	capillary tube
44	The automobile radiator is heat exchanger of			
	A	parallel flow type	B	counter flow type
	C	cross flow type	D	regenerator type
45	In the rolling process, roll separating force can be decreased by			
	A	reducing the roll diameter	B	increasing the roll diameter
	C	providing back-up rolls	D	increasing friction
46	In blanking operation, the angle of shear is provided on			
	A	die only	B	punch only
	C	both on die and punch	D	depends on material of work piece

47	In arc welding, eyes needed to protected against			
	A	Light only	B	infrared rays only
	C	ultraviolet rays only	D	ultraviolet and infrared rays
48	Open circuit voltage for arc welding is of the order of			
	A	18-40 volts	B	40-95 volts
	C	100-125 volts	D	130-170 volts
49	A steady rest is the lathe unit that is used for			
	A	supporting the bed	B	holding very long and heavy job
	C	external taper turning	D	performing the knurling operation
50	Which one of welding process consists of minimum heat affected zone?			
	A	SMAW	B	Laser beam
	C	Ultrasonic	D	MIG
51	Which of the following statements is false?			
	A	F: A ratio during starting an engine is about 0.2:1	B	F: A ratio during warming up of an engine is about 0.15:1
	C	F: A ratio during full throttle an engine is 1:1	D	F: A ratio during acceleration of an engine is about 0.1:1
52	A thin flat plate 2m by 2m is hanging freely in air. The temperature of the surrounding is 25°C. Solar radiation is falling on one side of the plate at the rate of 500 W/m <sup>2</sup> . The temperature of the plate will remain constant at 30°C if the convective heat transfer coefficient (in W/m <sup>2</sup> °C) is			
	A	25	B	50
	C	100	D	200
53	In a production turning operation, the foreman has decided that the single pass must be completed on the cylindrical work-piece in 5.0 min. The piece is 400 mm long and 200 mm in diameter. Using a feed = 0.30 mm/rev and a depth of cut = 4.0 mm, the cutting speed to meet this machining time requirement is			
	A	1257.0 m/min	B	125.7 m/min
	C	12.57 m/min	D	167.47 m/min
54	A refrigerator based on reversed Carnot cycle works between two such temperatures that the ratio between the lowest and highest temperature is 0.8. If a heat pump is operated between same temperature range, then what would be its COP?			
	A	2	B	3
	C	4	D	5
55	CPM consider the trade between cost and			
	A	man power	B	machines
	C	material	D	time
56	Feed drives in CNC milling machines are provided by			
	A	synchronous motors	B	induction motor
	C	stepper motor	D	servo motor
57	The type of layout suitable for use of the concept, principles and approaches of group technology is			
	A	product layout	B	job shop layout
	C	fixed position layout	D	cellular layout

58	PERT stands for			
	A	Project evaluation and review technique	B	Process evaluation and reporting technique
	C	Planning evaluation and reporting technique	D	Planning estimation and review techniques
59	A ring guage is used to measure			
	A	outside diameter but not roundness	B	roundness but not outside diameter
	C	both outside diameter and roundness	D	only external threads
60	A Mcleod guage is used for			
	A	discharge through a river	B	diameter of fine particles
	C	the acidity of solution	D	vaccum pressure
61	Heavy cuts can be given when machining on			
	A	Shaping machine	B	Slotting machine
	C	Planning machine	D	Drilling machine
62	Which of the following are not controllable errors?			
	A	Calibration errors	B	Environmental error
	C	Avoidable error	D	Random error
63	A Large hydraulic turbine is to generate 300 kW at 1000 rpm under a head of 40m. For initial testing, a 1:4 scale model of the turbine operates under a head of 10 m. The power generated by model in KW will be			
	A	2.34	B	4.68
	C	9.38	D	18.75
64	<p>The pressure in a capillary tube decreases due to which of the followings:</p> <ol style="list-style-type: none"> <li>1. Frictional resistance offered by the tube wall</li> <li>2. Acceleration of refrigerant in the tube</li> <li>3. Heat transfer from the tube</li> <li>4. Decrease in potential energy</li> </ol> <p>Select your answer from the following code:</p>			
	A	1 and 2	B	1, 2 and 3
	C	1, 2 and 4	D	1 and 4
65	Flank wear occurs mainly on			
	A	nose part and top face	B	cutting edges
	C	nose part, front relief face and side relief face	D	face of the cutting tool at a short distance from the cutting edge
66	Identify the machining method which uses abrasive slurry			
	A	EDM	B	ECM
	C	USM	D	LBM
67	shrink rule is used for providing			
	A	machining allowance	B	contraction allowance
	C	draft allowance	D	distortion allowance
68	In drawing operation the metal flows due to			
	A	ductility	B	work hardening
	C	plasticity	D	shearing

69	"Match List I (Components) with List (Functions) and select the correct answer: List I A. Steam trap B. Fusible plug C. Blow-off cock D. Feed check valve List II 1. Drains off water collected by condensation of steam in pipes 2. Controls rate of water flow to boiler 3. Puts off furnace fire when water level reaches unsafe limit 4. Removes mud and dirt collected at the bottom of boiler			
	A	A-3, B-1, C-4, D-2	B	A-1, B-3, C-2, D-4
	C	A-1, B-3, C-4, D-2	D	A-1, B-2, C-3, D-4
70	Which of the following pipe bends will introduce maximum head loss?			
	A	30° bend	B	45° bend
	C	60° bend	D	90° bend
71	A 100 c.c. I.C. engine means that its			
	A	swept volume is 100 c.c.	B	clearance volume is 100 c.c.
	C	clearance + swept volume is 100 c.c.	D	swept - clearance volume is 100 c.c.
72	100% efficiency of a thermal cycle cannot be achieved because of			
	A	frictional losses	B	it is not possible to achieve 0°K temperature
	C	leakage	D	non-availability of ideal substance
73	Gas turbines for power generation are normally used			
	A	to supply base load requirements	B	to supply peak load requirements
	C	to enable start thermal power plant	D	when other sources of power fail
74	In the graphical method of linear programming problem, the optimum solution would be lie in the feasible polygon at			
	A	its one corner	B	middle of any side
	C	its center	D	none of these three
75	Basic solution is one which has pH value			
	A	greater than 7	B	less than 7
	C	Equal to 7	D	pH value has nothing to do with basic solution
76	Which of the following is antifriction bearing			
	A	pedestal bearing	B	collar bearing
	C	full journal bearing	D	needle bearing
77	In testing of material for endurance strength, it is subjected to			
	A	Static load	B	dynamic load
	C	completely reversed load	D	impact load
78	A wire rope is designated as 6 x 19 standard hoisting. The numbers 6 x 19 represent			
	A	diameter in millimeter x length in meter	B	diameter in centimeter x length in meter
	C	number of strands x number of wires in each strand	D	number of wires in each strand x number of strands

79	The outside diameter of a hollow shaft is twice its inside diameter. The ratio of its torque carrying capacity to that of a solid shaft of the same material and the same outside diameter is			
	A	0.94	B	0.75
	C	0.5	D	0.0625
80	An ATC plays a significant role in reducing			
	A	Machining time	B	Tool change time
	C	W/P Loading time	D	Control time
81	Solution of differential equation $(e^y + 1)\cos x dx + e^y \sin x dy = 0$ is given by			
	A	$(e^y + 1)\sin x = c$	B	$(e^y + 1)\cos x = c$
	C	$(e^x + 1)\sin x = c$	D	$(e^x + 1)\sin y = c$
82	Solution of differential equation $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = \sinh x$ is given by			
	A	$y = c_1 e^{3x} + c_2 e^{-3x} + \frac{1}{32}(4e^x - e^{-x})$	B	$y = c_1 e^{3x} + c_2 e^{-3x} + (e^x - e^{-x})$
	C	$y = (c_1 + c_2 x)e^{-3x} + \frac{1}{32}(43e^x - e^{-3x})$	D	$y = (c_1 + c_2 x)e^{3x} + \frac{1}{32}(4e^x - e^{-x})$
83	Laplace Transformation of $t \cos 7t$ is equal to			
	A	$\frac{49}{(s^2 + 49)^2}$	B	$\frac{s^2}{(s^2 + 49)^2}$
	C	$\frac{s^2 - 49}{(s^2 + 49)^2}$	D	$\frac{49s^2}{(s^2 + 49)^2}$
84	Inverse Laplace Transformation of $\frac{1}{(s^2 - 24s + 153)}$ is equal to			
	A	$\frac{1}{12}e^{12t}\sin 3t$	B	$\frac{1}{3}e^{12t}\sin 3t$
	C	$\frac{1}{3}e^{3t}\sin 12t$	D	$\frac{1}{3}e^{12t}\cos 3t$
85	$\lim_{x \rightarrow \infty} (\tanh x)$ is equal to			
	A	1	B	0
	C	1/2	D	$\infty$
86	If $U = \sqrt{x^2 + y^2}$ then $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ is equal to			
	A	$2U$	B	$U$
	C	$3U$	D	0
87	If $\phi = 3x^2y + xz^3 - yz$ then $\text{curl}(\text{grad} \phi)$ is equal to			
	A	$i + 2j + k$	B	$i + j - k$
	C	0	D	$-i + 3j + k$
88	Vector Field $\vec{F} = 7i + xj + yk$ then $\text{curl} \text{curl} \vec{F}$ is			
	A	$i + j + 7k$	B	$i - 7j + k$
	C	$7i + j$	D	0



89	Which of the following is correct for the system $3x + 5y + z = 3, \quad x + 3y - 2z = 1, \quad 2x + 6y - 4z = 2$			
	A	Infinitely many solution	B	Unique solution
	C	No solution	D	None of these
90	If $A = \begin{bmatrix} 2 & 5 & 7 \\ 0 & 1 & 0 \\ 0 & 3 & 4 \end{bmatrix}$ then an Eigen values of $A^2$ are			
	A	1, 4, 9	B	1, 4, 16
	C	1, 4, 5	D	1, 2, 4
91	If $A = \begin{bmatrix} 0 & 0 & 1 \\ 2 & 3 & 7 \\ 1 & 5 & 7 \end{bmatrix}$ then rank of the matrix A is.			
	A	1	B	0
	C	3	D	2
92	If $f(z) = \frac{z^2-9}{(z+1)(z^2-6z+9)}$ which are the points where $f(z)$ fails to be analytic ?			
	A	-1, 3	B	1, 3
	C	1, -3	D	3, -3
93	Value of $\int_c \frac{1}{(z-1)^4} dz$ , ( where $c$ is $ z  = 1/2$ ) is.			
	A	$3\pi i$	B	$2\pi i$
	C	$\pi i$	D	0
94	Residue of $f(z) = \frac{z-1}{(z-4)(z-7)}$ at pole 7 is.			
	A	7	B	2
	C	3	D	1
95	The Mean, Median and mode of 30, 35, 33, 37, 30 are.			
	A	Mean=33, Median=33, Mode= 30	B	Mean=35, Median=34, Mode= 33
	C	Mean=33, Median=35, Mode= 30	D	Mean=35, Median=34, Mode= 30
96	If A and B are independent event where $P(A)=2/5$ and $P(B)=1/3$ then $P(A \cup B)$ is			
	A	1/5	B	3/5
	C	2/5	D	4/5
97	The lifetime T of an alkaline battery is exponentially distributed with $\lambda = 0.05$ per hour. What is the standard deviation of the battery life time ?			
	A	25 hrs.	B	30 hrs.
	C	20 hrs.	D	35 hrs.

98	Value of $\int_1^2 \frac{1}{x} dx$ with $h = 0.5$ by Simpsons $\frac{1}{3}$ rule is.			
	A	0.694	B	0.496
	C	0.946	D	0.759
99	A numerical solution of the equation $f(x) = x^3 + 7x - 3 = 0$ can be obtained using Newton-Raphson method. If the initial guess $x_0 = 1$ for the iteration then what is the value of first iteration?			
	A	1.5	B	0.25
	C	0.5	D	0.15
100	If $\frac{dy}{dx} = 2x - y$ and $y(0) = 1$ , taking $h=0.1$ using second order Runge-Kutta method what is the value of $y(0.1)$ ?			
	A	1.6	B	0.5
	C	0.6	D	1.5