

Seat No. _____

SUB: MECHATRONICS (MC)

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. 5/2 way single solenoid valve has
A 2 ports 2 position
B 5 ports 2 position
C 5 ports 5 position
D 2 ports 5 position
2. The designation M 33 x 2 of a bolt means
A metric threads of 33 nos in 2 cm
B metric threads with cross-section of 33 mm
C metric threads of 33 mm outside diameter and 2 mm pitch
D bolt of 33 mm nominal diameter having 2 threads per cm
3. Which of the following is the output of a thermocouple ?
A Alternating current
B Direct current
C A.C. Voltage
D D.C. Voltage
4. LVDT windings are wound on
A copper
B ferrite
C aluminium
D steel sheets (laminated)
5. The resistivity of the conductor depends on
A material of conductor
B area of conductor
C length of conductor
D none of above
6. In 8085 microprocessor, the RST6 instruction transfer programme execution to following location
A 0024H
B 0030H
C 0048H
D 0060H
7. The circuits in the 8085A that provide the arithmetic and logic functions are called the
A CPU
B ALU
C I/O
D None of these
8. Lowest critical frequency is due to pole and it may be present origin or nearer to origin, then it is which type of network?
A LC
B RL
C RC
D any of the above
9. A control system in which the control action is somehow dependent on the output is known as
A closed loop system
B open loop system
C semiclosed loop system
D none of the above
10. One of the properties of Linear Programming Model is
A it will not have constraints
B it should be easy to solve
C it must be able to adopt to solve any type of problem
D the relationship between problem variables and constraints must be linear

11. In transportation problem the column, which is introduced in the matrix to balance the rim requirements, is known as:

A dummy column	B idle column
C slack column	D key column
12. In Hungarian method of solving assignment problem, the row opportunity cost matrix is obtained by:

A dividing each row by the elements of the row above it	B subtracting the elements of the row from the elements of the row above it
C subtracting the smallest element from all other elements of the row	D subtracting all the elements of the row from the highest element in the matrix
13. Group replacement policy is most suitable for:

A trucks	B infant machines
C street light bulbs	D new cars
14. PLCs are _____ designed for use in the control of a wide variety of manufacturing machines and systems

A special-purpose industrial computers	B personal computers
C electromechanical systems	D All of the above
15. The PLC is used in _____

A machine tools	B automated assembly equipment
C moulding and extrusion machines	D all of the above
16. For handling greater currents induction wattmeters are used in conjunction with

A potential transformers	B current transformers
C power transformers	D either of the above
17. Induction type single phase energy meters measure electric energy in

A kW	B Wh
C kWh	D VAR
18. The direction of rotation of a D.C. series motor can be changed by

A interchanging supply terminals	B interchanging field terminals
C either of (A) and (B) above	D None of the above
19. Differentially compound D.C. motors can find applications requiring

A high starting torque	B variable speed
C frequent on off cycles	D low starting torque
20. Starters are used with D.C. motors because

A these motors have high starting torque	B these motors are not selfstarting
C to restrict armature current as there is no back e.m.f. while starting	D back e.m.f. of these motors is zero initially
21. When measuring power in a circuit with low current, the wattmeter current coil should be connected

A to the load side	B to the source side
C anywhere, either load side or source side, does not matter	D in series with the load along with CT for current amplification
22. The time base signal in a CRO is

A a sinusoidal signal	B a square wave signal
C a triangular wave signal	D a sawtooth signal
23. A car is raining at a constant speed of 50 km/h, which of the following is the feedback element for the driver?

- A Clutch
C Needle of the speedometer
- B Eyes
D Steering wheel
24. Assignment problem is basically a
A Maximisation Problem
C Primal problem
- B Transportation Problem
D Minimisation Problem
25. If primal problem is a maximisation problem, then the dual will be
A Maximisation Problem
C Mixed Problem
- B Minimisation Problem
D None of the above
26. The corrosion resistance property of stainless steels is due to the presence of
A manganese
C cobalt
- B chromium
D silicon
27. Recrystallization temperature is one
A at which crystals first start forming from molten metal when it is cooled
C at which new spherical crystals first begin to form from the old deformed one when a strained metal is heated
- B at which change of allotropic form takes place
D at which crystals grow bigger in size
28. The transfer function is applicable to which of the following?
A Linear and time invariant systems
C Linear systems
- B Linear and time variant systems
D Nonlinear systems
29. The initial response when the output is not equal to input is called
A transient response
C dynamic response
- B error response
D either of the above
30. In electro pneumatic system analogy the current is considered analogous to
A velocity
C air flow
- B pressure
D air flow rate
31. The working cycle in case of four stroke engine is completed in following number of revolutions of crankshaft
A $1/2$
C 2
- B 1
D 4
32. Scavenging air in diesel engine means
A air used for combustion sent under pressure
C burnt air containing products of combustion
- B forced air for cooling cylinder
D air used for forcing burnt gases out of engine's cylinder during the exhaust period
33. In S.I. units pressure is expressed in
A kgf/cm^2
C N/m^2 or bar
- B mm. of mercury
D None of the above
34. A perfect gas is one which obey's
A all gas laws
C only Charle's law
- B only Boyle's law
D none of the above
35. Work done is zero in case of
A adiabatic process
C constant volume process
- B polytropic process
D isothermal process
36. During the transformation of water into steam, the temperature remains constant, the heat added is known as
A liquid heat
- B total heat

37. Compression ratio of LC. engines is
- | | |
|--|--|
| C latent heat of steam | D specific heat |
| A the ratio of volumes of air in cylinder before compression stroke and after compression stroke | B volume displaced by piston per stroke and clearance volume in cylinder |
| C ratio of pressure after compression and before compression | D swept volume/cylinder volume |
38. is used to drive a rotary compressor
- | | |
|-------------|------------------|
| A Engine | B Electric motor |
| C Air motor | D Either A or B |
39. In a steam engine can be a horizontal, vertical or inclined. This classification is according to the
- | | |
|------------------------|------------------------|
| A expansion of steam | B position of cylinder |
| C field of application | D speed of the engine |
40. Reciprocating compressors are employed to compress air up to a pressure of bar
- | | |
|------|-----------------|
| A 20 | B 40 |
| C 80 | D More than 100 |
41. In a typical medium speed 4stroke cycle diesel engine the inlet valve opens
- | | |
|---|---|
| A at 20° before top dead center and closes at 35° after the bottom dead center | B opens at top dead center and closes at bottom dead center |
| C opens at 10° after top dead center and closes 20° before the bottom dead center | D may open or close anywhere |
42. The common refrigerant used in domestic refrigerator is
- | | |
|-----------|-------------------|
| A Ammonia | B Sulphur dioxide |
| C Freon | D Carbon dioxide |
43. A hydraulic accumulator normally consists of
- | | |
|--|--|
| A two cylinders, two rams and a storage device | B a cylinder and a ram |
| C two coaxial rams and two cylinders | D a cylinder, a piston, storage tank and control valve |
44. Hydraulic and pneumatic circuits
- | | |
|--|---|
| A Perform the same way for all functions | B Perform differently for all functions |
| C Perform the same with some exceptions | D Does not perform all the functions |
45. The use of compressor is not required in
- | | |
|-----------------------------|-----------------------------|
| A Vapour compression system | B Bell coleman refrigerator |
| C Vapour absorption system | D Air refrigeration system |
46. If the initial tension in the belt is increased
- | | |
|---|--|
| A the power transmitted by the belt increases | B the power transmitted by the belt reduces |
| C the power transmitted may increase upto a limit and then decrease | D the power transmitted by the belt remains same |
47. For constant velocity ratio positive drive with large centre distance between driver and driven shaft
- | | |
|---------------------------|------------------------|
| A gear drive is used | B V-belt drive is used |
| C flat belt drive is used | D chain drive is used |
48. Displacement, velocity and acceleration of a particle are

- C clearance angle D lip angle
63. Cast iron and steel pipes are produced by
A slush casting B investment casting
C centrifugal casting D die casting
64. Critical path is ascertained in
A CPM method B PERT method
C both of the above D none of the above
65. Optical flats are made of
A quartz B glass
C plastics D fiber
66. Micro-controllers are _____ than the PLCs
A bulky and expensive B portable and cheaper
C bulky but cheaper D portable but expensive
67. The type of memory which is fast and temporarily stores the data which are immediately required for use is called as _____
A HDD B ROM
C SSD D RAM
68. CAD/CAM is the relationship between
A science and engineering B design and manufacturing
C manufacturing and marketing D design and marketing
69. The basic geometric building blocks provided in a CAD/CAM package are
A points B lines
C circles D all of the mentioned
70. Which materials-processing technology gives the advantage of precision, accuracy and optimum use of cutting tools, which maximise their life and higher labour productivity?
A Flexible manufacturing systems (FMS) B Industrial robots
C NC (and CNC) machine tools D Computer-integrated manufacturing (CIM)
71. Surface grinding is done to produce
A tapered surface B flat surface
C internal cylinder holes D all of these
72. Which of the following sensors determines the relationship of the robot and its environment and the objects handled by it
A internal state sensors B external state sensors
C both (a) and (b) D none of the above
73. The Robot designed with cylindrical coordinate systems has
A two linear and one rotational movement B three linear movements
C three rotational movements D two rotational and one linear movement
74. A twist drill is specified by its
A shank, material and diameter B shank, lip angle and size of flute
C material, length of body and helix angle D any one of these
75. The type of tool used on milling machine and broaching machine is
A single point cutting tool B two point cutting tool
C three point cutting tool D multipoint cutting tool
76. Following are the advantages of hot working of metals, except

- A close tolerances can be maintained
C grain structure of the metal is refined
- B porosity of the metal is minimized
D no residual stresses are introduced
77. In rolling, the pressure is maximum at
A entrance
C both the extremities
- B exit
D at a point somewhat between the two extremities
78. Which is false statement about annealing.
Annealing is done to
A relieve stresses
C improve machining characteristic
- B harden steel slightly
D soften material
79. In which of the following process the ductility of material decreases?
A hot working
C warm working
- B cold working
D none of the mentioned
80. Finite element method formulation of problem results in a system of
A algebraic equations
C Arthimatic equations
- B logical equations
D flow equations
81. The rank of a matrix $\begin{bmatrix} 2 & 4 & 6 \\ 0 & 3 & 1 \\ 0 & 0 & 5 \end{bmatrix}$ is
A 2
C 0
- B 3
D 1
82. A linear system $x + 2y + 3z = 2$, $2x + y + z = 1$, $x + y + 2z = 3$ has
A Infinite number of solutions
C Unique solution
- B No Solution
D None of these
83. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 3 & 0 \\ 4 & 6 & 7 \end{bmatrix}$ then eigen values of A^{-1} are
A $1, \frac{1}{3}, \frac{1}{7}$
C 3, 7, 1
- B 2, 4, 6
D 1, 3, 7
84. If $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ then $A^3 - 5A^2 + 7A - 3I$ is equal to
A Identity Matrix
C Null Matrix
- B Non-Singular Matrix
D None of these
85. $\lim_{x \rightarrow 0} \frac{5 \sin x - 3 \tan x}{x^2}$ is equal to
A 1
C 3
- B 2
D 0
86. The value of improper integral $\int_0^\infty e^{-2x} dx$ is
A 0
C 1
- B $\frac{1}{2}$
D 2
87. If $U = \tan^{-1} \left(\frac{x-y}{x+y} \right)$ then $x \frac{\partial U}{\partial x} + y \frac{\partial U}{\partial y}$ is equal to
A U
C 3U
- B 2U
D 0
88. If $\phi = x^2 y z$ then $\text{curl}(\text{grad} \phi)$ is
A $\nabla \phi$
C 0
- B $\nabla^2 \phi$
D $\nabla^3 \phi$

- 89 The value of $\oint_C y^2 dx + 3xydy$, where C is square bounded by $x = 0$, $x = 1$, $y = 0$ and $y = 1$ is
- A $\frac{1}{2}$ B 2
C $\frac{1}{3}$ D 3
- 90 Solution of $(e^y + 1) \cos x dx + e^y \sin x dy = 0$ is
- A $e^y \sin x = c$ B $(e^y + 1) \sin x = c$
C $(e^y + 1) \cos x = c$ D $e^y \cos x = c$
- 91 Solution of $\frac{d^2y}{dx^2} - 10\frac{dy}{dx} + 25y = e^{5x}$ is
- A $C_1 e^{5x} + C_2 e^{-5x} + x^2 e^{5x}$ B $(C_1 + C_2 x) e^{-5x} + x^2 e^{-5x}$
C $(C_1 + C_2 x) e^{5x} + \frac{x^2}{2} e^{5x}$ D $(C_1 + C_2 x) e^{5x} + x e^{5x}$
- 92 Inverse Laplace transformation of $\frac{1}{s^2(s^2+1)}$ is
- A $t \sin t$ B $t^2 + \sin t$
C $t - \sin t$ D $2t + \sin 2t$
- 93 Which one is Analytic function
- A e^Z B \bar{Z}
C $|Z|$ D $Z\bar{Z}$
- 94 Value of $\int_C \frac{3Z}{Z-1} dZ$, (where C is $|Z-1| < 2$) is
- A $6\pi i$ B $2\pi i$
C πi D $4\pi i$
- 95 Residue of $f(Z) = \frac{5}{Z^2(Z-3)}$ at simple pole is
- A 0 B 5
C $\frac{5}{9}$ D 9
- 96 Newton-Raphson iteration formula for $x^2 - x + 1 = 0$ is
- A $x_{n+1} = \frac{2x_n^2 - 1}{2x_n}$ B $x_{n+1} = \frac{2x_n^2 - 1}{2x_n - 1}$
C $x_{n+1} = \frac{x_n^2 + 1}{2x_n - 1}$ D $x_{n+1} = \frac{x_n^2 + 2}{2x_n - 1}$
- 97 Value of integral $\int_0^1 \frac{1}{1+x} dx$ using Simpson's 3/8 rule with step size $h = 0.25$ is
- A 0.6932 B 0.9673
C 0.6833 D 0.9633
- 98 If $\frac{dy}{dx} = x - y^2$, $y(0) = 1$, $h = 0.1$, by Runge-Kutta second order method to what is an approximate value of $y(0.1)$
- A 0.9145 B 0.7665
C 0.6555 D 0.9589
- 99 Three coins are tossed together and let random variable X be the number of heads in each outcome then Standard deviation is

	A	$\frac{\sqrt{5}}{2}$	B	$\frac{1}{2}$
	C	$\frac{\sqrt{5}}{3}$	D	$\frac{\sqrt{3}}{2}$
100	In binomial distribution formula of calculating mean is			
	A	$\mu = p + q$	B	$\mu = np$
	C	$\mu = pq$	D	$\mu = nq$