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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (S, FE) Examination January 2024 (2019 Scheme)

Course Code: RAT308

Course name: COMPREHENSIVE COURSE WORK

Max. Marks: 50 Duration: 1Hour

Instructions:

(1) Each question carries one mark. No negative marks for wrong answers

(2) Total number of questions: 50

(3) All questions are to be answered. Each question will be followed by 4 possible answers of which only ONE is correct.

(4) If more than one option is chosen, it will not be considered for valuation.

(5) Calculators are not permitted

1. D-Alembert's principle is used for which of the following?

a) Change the static problem into a dynamic problem
b) Change dynamic problem to static problem
c) To calculate the moment of inertia of rigid bodies
d) To calculate angular momentum of a system of masses

2. Which of the following mechanism is an approximately straight-line motion mechanism?

a) Hart's mechanism
b) Watt's mechanism
c) Scott Russell's mechanism
d) Peaucellier mechanism

3. Which of the following is a higher pair?

a) ball and roller bearing
b) automobile steering gear
c) cam and follower
d) belt and chain drives

4. The component of the acceleration, parallel to the velocity of the particle, at the given instant, is called _____ component.

a) radial
b) tangential
c) Coriolis
d) Axial

5. In a virtual work method, the virtual quantity is .....

a) displacement
b) load
c) slope
d) moment

6. In a kinematic chain, a quaternary joint is equivalent to

a) Two binary joints
b) Three binary joints
c) Four binary joints
d) Five binary joints

7. ABCD is a four-bar mechanism. AD is the fixed link. AB=70mm, BC=90mm, CD=60mm and AD=50mm. Identify the type of mechanism.

a) Crank-rocker
b) Double-crank
c) Double-rocker
d) None of these

8. A combination of kinematic pairs, joined in such a way that the relative motion between the links is completely constrained, is called

a) Mechanism
b) Kinematic chain
c) Inversion
d) Structure

9. A kinematic chain is called a mechanism when

a) none of the links is fixed b) one of the links is fixed c) two of the links are fixed d) all of the links are fixed

10. Which of the following deals with finding the position and orientation of robots, for a given joint variable?

a) Forward Kinematics b) Forward Dynamics c) Inverse Kinematics d) Inverse Dynamics

11 Auxiliary carry is set during which condition?

a) When carry is generated from D3 to D4 b) When carry is generated from D7 c) When carry is generated from both D3 to D4 and D7 d) When carry is generated at either D3 to D4 and D7

12 Find the machine cycle for 8051 if XTAL frequency is 11.0592 MHz

a) 90.42μs b) 361.68μs c) 1.085μs d) 150.145μs

13 What is the operation for Timer Mode 2 in 8051?

a) 13-bit timer mode, 8-bit timer/counter THx and TLx as 5-bit prescaler b) 16-bit timer mode, 16-bit timer/counter THx and TLx are cascaded, no prescaler c) 8-bit auto reload mode, 8 bit auto reload timer/counter, THx holds a value which is to be reloaded to TLx each time it overflows d) Split timer mode status

14 External Access in 8051 is used to permit _____

a) Peripherals b) Power supply c) ALE d) Memory interfacing

15 If RS1 = 1, RS0 = 1 then the register bank selected is

a) Register bank 0 b) Register bank 1 c) Register bank 2 d) Register bank 3

16 Which of the following file extension that is loaded in a microcontroller for executing any instruction?

a) .c b) .txt c) .hex d) .doc

17 When the microcontroller executes some arithmetic operations, then the flag bits of which of the following register are affected?

a) DPTR b) PSW c) PC d) SP

18 The data pointer in an 8051 architecture is a _____

a) 8-bit register b) 16-bit register c) 32-bit register d) none of these

19 What is the use of the Arduino.h header file?

a) It enables the programmer to access all of Arduino's core functionality
b) It doesn't have any use and can be omitted at any point of time in the code
c) It gives root access to the microcontroller's file system
d) It allows other people to create libraries for the Arduino code

20 Which of the following can be used for long distance communication?

a) I2C
b) Parallel port
c) SPI
d) RS232

21 Insertion of negative feedback in control system affects:

a) The transient response to vanish uniformly
b) The transient response to decay very fast
c) No change in transient response
d) The transient response decays at slow rate

22 Which of the statement is correct with regard to the bandwidth of the control loop system:

a) In systems where the low frequency magnitude in 0 dB on the bode diagram, the bandwidth is measured at the -3 dB frequency
b) The bandwidth is the measurement of the accuracy of the closed loop system
c) The stability is proportional to the bandwidth
d) The system with larger bandwidth provides slower step response and lower fidelity ramp response

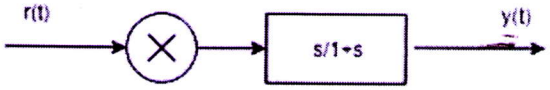
23 A third order system is approximated to an equivalent second order system. The rise time of this approximated lower order system will be:

a) Same as the original system for any input
b) Smaller than the original system for any input
c) Larger than the original system for any input
d) Larger or smaller depending on the input

24 Which of the following transfer function will have the greatest maximum overshoot?

a) 9/(s2+2s+9)
b) 16/(s2+2s+16)
c) 25/(s2+2s+25)
d) 36/(s2+2s+36)

25 . Consider the following system shown in the diagram:



If the system shown in the above diagram x (t) = sin t. What will be the response y (t) in the steady state?

a) sin(t-45)/√2
b) sin(t+45)/√2
c) √2e-5sin t
d) sin t-cos t

26 Regenerative feedback is feedback with----------

a) Positive sign
b) Negative Sign
c) Oscillations
d) Step Input

27 Frequency at which phase frequency response plot equals to 180° is called----------

a) gain frequency
b) gain margin frequency
c) damped frequency
d) critical frequency

28 A linear system at rest is subject to an input signal $r(t)=1-e^{-t}$. The response of the system for $t>0$ is given by $c(t)=1-e^{-2t}$. The transfer function of the system is:

a) (s+2)/(s+1) b) (s+1)/(s+2) c) 2(s+1)/(s+2) d) (s+1)/2(s+2)

29 Time required for the step response to go from 0.1 of the final value of 0.9 of the final value is called ----------

a) Rise Time b) Fall Time c) Peak time d) Slew rate

30 Which is the strongest method for stability analysis and transient analysis of systems?

a) Bode plot b) Nyquist plot c) Routh- Hurwitz criterion d) Root locus

31 The _____ represents the portion of space around the base of the manipulator that can be accessed by the arm endpoint.

a) work envelope b) work volume c) work space d) trajectory

32 A robot configuration whose movements are referred to as base rotation, elevation (height) and reach is the

a) Cartesian Configuration b) Cylindrical Configuration c) Spherical Configuration d) Anthropomorphic Configuration

33 The _____ configuration requires the least floor space for a given work volume while the _____ configuration requires a large floor space.

a) cartesian, articulated b) articulated, rectangular c) cylindrical, cartesian d) spherical, cylindrical

34 To achieve good precision under heavy load conditions, ... loop control is necessary and such robots are called .....

a) open, servo controlled b) closed, servo controlled c) open, non-servo controlled d) closed, non-servo controlled

35 A helical joint has ___ DOF, while a cylindrical joint has _____ DOF.

a) 1, 3 b) 2, 1 c) 1, 2 d) 2, 3

36 In a friction-based gripper, the gripping force required to grasp an object can be reduced by

a) decreasing coefficient of friction and/or decreasing the number of contacting surfaces b) increasing coefficient of friction and/or decreasing the number of contacting surfaces c) decreasing coefficient of friction and/or increasing the number of contacting surfaces d) increasing coefficient of friction and/or increasing the number of contacting surfaces

37 In a 3R concurrent or spherical wrist, the three wrist joints are _____ and the three joint axes are mutually _____.

a) revolute, parallel b) prismatic, orthogonal c) prismatic, parallel d) revolute, orthogonal

38 A servomotor can be

a) DC motor b) AC motor c) Stepper motor d) All of these

39 Robotic subsystems are

a) motion, recognition and control subsystems
b) motion, recognition and vision subsystems
c) motion and control subsystems
d) None of these

40 The individual bodies that make up a robot are called

a) links
b) joints
c) actuators
d) sensors

41 Identify the incorrect statement from the following.

a) LVDT has natural null point in middle.
b) LVDT consumes very low power during its operation.
c) Due to the absence of friction, dynamic response of LVDT becomes very fast to change in a core position.
d) LVDT gives high hysteresis losses hence repeatability is poor under any condition.

42 _____ describes current flow between two junctions formed by two different metals.

a) Peltier effect
b) Thomson effect
c) Seebeck effect
d) None of the mentioned

43 Capacitive transducers can be used by _____

a) Measuring change in distance between plates
b) Measuring change in area of plates
c) Change in a dielectric material
d) All of the mentioned

44 Photo resistive cells are _____

a) Active device
b) Passive device
c) Insulating device
d) None of the mentioned

45 In rotary variable differential transformer, the mutual inductance between the primary and secondary coils varies

a) Linearly with the angular displacement
b) Non - linearly with the angular displacement
c) Linearly with the linear displacement
d) Non - linearly with the linear displacement

46 The main purpose of a human-machine interface (HMI) is

a) To connect industrial equipment to the internet
b) To allow communication between humans and machines
c) To automate decision-making processes
d) To monitor environmental conditions in a facility

47 An actuator in an automated system

a) Collect and analyze data
b) Convert electrical energy into mechanical motion
c) Control the flow of electricity
d) Measure and record physical quantities

48 What does the term "scan time" refer to in the context of PLCs?

a) The time taken to execute a single rung of ladder logic
b) The time taken to download a program to the PLC
c) The time taken to power up the PLC
d) The time taken for communication between multiple PLCs

49 Consider the following statements regarding optical encoders

1. Optical encoders convert the linear motion or angular displacement into digital signals.
2. Absolute encoders are used to sense actual position with respect to fixed frame of reference.
3. Incremental encoders are used to sense the actual position with respect to the previous position.

Which of the above statements are true?

a) 1 and 3
b) 1 and 2
c) 2 and 3
d) 1, 2 and 3

50 The switch that has the fastest speed of operation is …….. switch

a) Electronic
b) Mechanical
c) Electromechanical
d) None of these

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