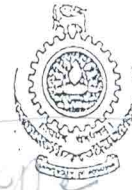UNIVERSITY OF MORATUWA, SRI LANKA
FACULTY OF ENGINEERING

MID-TERM EXAMINATION (Held in Sep 2007)
B.Sc. ENGINEERING LEVEL 2, SEMESTER 1

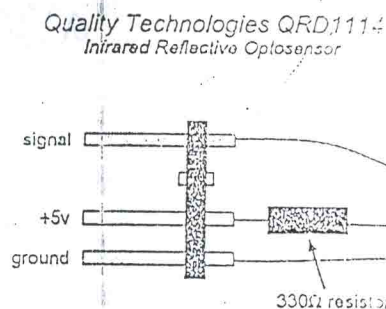DE 206 – ROBOT DESIGN AND COMPETITION

Answer ALL questions in the answer sheet provided.   *Time allowed: 90 minutes*

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1. Which of the following statements is not true about 28 ... ribbon cable, which is widely used in small robots
   a) it zips multiple wires
   b) it is stranded and flexible
   c) its multicolours are helpful
   d) it has quite good current handling capacity

2. Which of the following statements is not true about soldering
   a) strip 1/8"~1/4" insulation at wire ends
   b) tin the ends evenly
   c) always use a standard heat gun for heat shrink
   d) use 1/4" heat shrink tubing

3. A reflective optosensor is shown below. Which of the following statements is not true

Quality Technologies QRD1114
Infrared Reflective Optosensor

   a) It does not operate properly as it is
   b) 330Ω resistor is used to makes a voltage divider circuit
   c) 330Ω is used to limits the current through the emitter
   d) the sensor gives an analog signal

4. Which of the following statements is not true about IR sensors
   a) they are susceptible to ambient light
   b) they always need signal conditioning for proper operation
   c) they can be used as analog or a digital sensor
   d) they need to be calibrated

5. The output voltage of an unregulated 12V power pack used in robot control boards is measured when is not not connected to the robot. The reading will roughly be
   a) 12V   b) 10V   c) 16V   d) cannot say

Piggyback

6. Your motor control board allows 1A, if you want to drive 2A motor what will you be doing
   a) piggyback another motor driving IC on the same board
   b) change the board to 2A rated one
   c) use the same board with short duty ratios
   d) none of the above

7. When does a motor draw maximum current
   a) when it starts.
   b) when the motion is blocked
   c) when it runs with maximum speed
   d) when it drives its rated load.

8. Stall current of a motor
   a) is the maximum current it draws
   b) is the maximum current it can handle
   c) is measured when the motor runs at rated RPM
   d) is written on the motor cover

9. Motor driving IC should be able to
   a) deliver rated current of the motor intermittently
   b) deliver stall current of the motor at rate speed
   c) deliver rated current of the motor continuously
   d) deliver the stall current of the motor continuously

10. Your motor control board is 6V rated. Which of the followings is not true
    a) you can drive a 9V motor from the board at 66% duty
    b) a 5V motor will run faster when driven by the board
    c) you can drive a 9V motor from the board at slow speeds
    d) you can continuously drive 4V motor from the board

11. Which of the following statements most accurately describe an H-bridge
    a) it is used for direction control of DC motors
    b) it has 4 switching signals
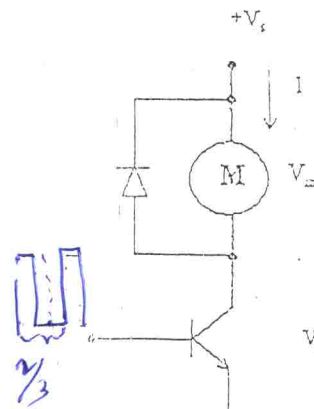   c) it has 3 logic control signals
    d) Has 4 logic gates.

12. Which of the following components is not present in a servo system
    a) DC motor   b) Gear reducer
    c) Encoder   d) speed sensor

13. Qudrature shaft encoding
    a) always needs two break-beam sensors
    b) needs a lookup table
    c) senses direction of motion of wheels
    d) all of the above

14. Which of the following statements is not true about Sense-Plan-Act (SPA) strategy of robot control
    a) it is a relatively slow strategy
    b) it is not appropriate to achieve multiple objective
    c) at each step, sensor fusion, world modeling, and planning are involved before action
    d) is not applicable for complex, dynamic environments

15. A PWM motor control circuit is shown. Which of the following statements is not true
    a) motor draws roughly 2/3 of the rated power
    b) Motor runs at roughly 2/3 of its rated speed
    c) motor draws roughly 2/3 of the rated current
    d) diode conducts when the transistor is OFF.

16. Pulse Width Modulation
    a) needs very high switching frequency
    b) is used for speed control of DC motors
    c) is used for servo position control
    d) can be used for step motor control

17. In servo motors
    a) there are three wires
    b) PWM is used to command reference shaft angle
    c) shaft can be positioned anywhere within 360°
    d) speed control is not possible

18. Winch servo
    a) is a servo motor without feedback signal
    b) is a modified servo system for speed control
    c) is a modified servo for more power
    d) uses the PWM control signal to command the speed

19. Which of the followings is not correct about unipolar steppers motors
    a) there are 5 or 6 wires
    b) direction of motion is changed by changing direction of current through coils
    c) coils can be identified by measuring resistance between wires
    d) speed is proportional to pulse frequency

20. In a four-phase unipolar step motor
    a) 8-step sequence doubles the resolution of motion
    b) 8-step sequence increases torque by 1.4 times
    b) energizing two coils at a increases resolution of motion
    c) energizing two coils at a time doubles the torque

21. The following are statements with respect to a sonar sensor
    (i) A sonar sensor can be used for distances of many kilometers
    (ii) The sonar sensor will fail if the surface is uneven and absorptive
    (iii) Sonar sensors fail when the transmitted pulse hits a corner at an angle of 45°.

    Which of the above statements are true?
    a) (i) only   b) All three
    c) (i) and (iii) only   d) (ii) and (iii) only

22. Diode protection is required for motors because
    a) The deenergized winding of a motor will induce a very high voltage
    b) The winding produces a very high voltage due to the back-emf
    c) The motor should be protected from accidental reverse polarity
    d) None of the above statements are true

23. The use of large wheels for robotic craft result in,
    a) Better handling of rough terrain but lower torque
    b) Better handling of rough terrain and higher torque
    c) Poor handling of rough terrain but higher torque
    d) None of the above

24. Which of the following methods cannot be used to determine the velocity of a motor?
    a) Measurement of the current through the coil of the motor
    b) Measurement of the back EMF
    c) A DC dynamo connected to the motor shaft
    d) An encoder connected to the motor shaft

25. What is not a problem involved with the use of back EMF based measurements?
    a) The transient spikes due to the winding of the motor
    b) Handling the possible bi-directional polarity of the back EMF
    c) The high current generated by the back EMF
    d) The inertia of the shaft of the motor

26. Which of the following statements are true about microcontrollers
    (i) Microcontrollers should be protected from stray static electric discharges
    (ii) All microcontrollers can be used for A⇔D conversion, RS232 interfacing and PWM
    (iii) Most microcontrollers can be programmed using both low level and high level programming languages

    a) (i) only   b) All three   c) (ii) and (iii) only   d) (i) and (ii) only

27. When selecting Bipolar Junction Transistors (BJT's) and Field Effect Transistors (FET's) for a switching application the main drawback for each option would be,
    a) The high energy wastage of BJT's and the low gate current of FET's
    b) The high energy wastage of BJT's and high cost of FET's
    c) The high cost of BJT's and the static sensitivity of FET's
    d) All of the above statements are true

28. The main error causing factors in the Global Positioning System (GPS) are,
    a) Bending in the ionosphere, imprecise clock and noise in the receiver and reflections
    b) Bending in the ionosphere, cosmic noise, interference from commercial radio stations
    c) Cosmic noise, reflections and interference from commercial TV stations
    d) Imprecise clock and noise in the receiver, reflections and cosmic noise

29. GPS coverage can become temporarily unavailable due to,
    a) Satellite failure, orbit deviations and solar flares
    b) Interference due to cosmic noise, solar flares and the magnetic field of the earth
    c) Blocking of the signals due to clouds, vegetation, terrain or buildings
    d) Blocking of the signals due to birds and vegetation

30. What is not an use of a sonar sensor?
    a) Obstacle detection
    b) Obstacle range measurement
    c) Obstacle texture detection
    d) Building of a map of obstacles using sonar

31. What is the voltage required to operate the PIC18F452 microcontroller.
    a) 5V   b) 6V   c) 12V   d) 9V

32. What is the regulator IC used to achieve above voltage?
    a) LM7805   b) LM7906   c) LM317   d) LM7905

33. What is communication protocol used by the development board to communicate with the computer.

a) RS232   b) USB   c) RS422   d) RS485

34. What is the motor control IC used in the motor control board?

a) L298   b) L293   c) Max232   d) Max233

35. What is the maximum current limit (for One H Bridge) of the above motor control IC?

a) 1A   b) 2A   c) 3A   d) 4A

36. How to protect Motor control IC from the back EMF of the motor?

a) Using Free wheeling Diodes   b) Using Resistors
c) Using Low ESD capacitors   d) Using Zenner Diodes.

37. How many analog pins are available in the PIC18F452?

a) 5   b) 8   c) 10   d) 12

38. In the development board the crystal used to clock the microcontroller is 10 MHz. But microcontroller is running at 40 MHz clock speed. How this speed increase is achieved.

a) Using Internal PLL   b) Using External PLL
c) Using Frequency Multiplexer   d) Using Frequency divider

39. Development board has SPI (Serial Peripheral Interface) port to communicate with other Devices or microcontrollers. What is the accurate expression about the SPI communication?

a) It is Asynchronies communication   b) It is a Synchronies communication
c) It is half duplex communication   d) It is uni-directional communication

40. How many signals (wires except ground) involve in SPI communication?

a) 2   b) 3   c) 4   d) 6