(1) Find the solution for the following differential equation. (15%)

$$y' = 3x^2 - \frac{y}{x} \quad : \qquad y(1) = 5$$

(2) Find the general solution for the following differential equation. (20%)

$$y'' + 2y' + y = -3e^{-x} + 8xe^{-x} + 2\sin(x) + 1$$

(3) Find the Laplace transform of the function $f(t) = te^{-2t}\cos(3t)$. (10%)

(4) Solve the following differential equations. (20%)

$$\begin{cases} x'' - 2x' + 3y' + 2y = 4 \\ -x' + 2y' + 3y = 0 \end{cases} , \qquad x(0) = x'(0) = y(0) = 0$$

(5) Using the Cramer's rule, solve the following equations (20%)

$$\begin{cases} x - y + 2z = -5 \\ -x \quad + 3z = 0 \\ 2x + y \quad = 1 \end{cases}$$

(6) Find the determinants and the eigenvalues of $A = \begin{bmatrix} 4 & -5 \\ 1 & -2 \end{bmatrix}$ (15%)

I. (24%) Choose the correct word from each parenthesis and write them down on the answer sheet.

1. (When; During) electric current is the (manipulating; manipulated) variable in a closed-loop control system, the final (corrected; correcting) device is often a relay or a contactor. For example, in an electric (heat; heating) process,the temperature might be controlled in the ON-OFF mode simply by opening and closing a contact (lead; leading) to the heating element.

2. The ADC 0808 is an 8-bit analog-to-digital converter. It uses successive approximation as the conversion (technique; skill). It features a high (impedance; resistance) chopper comparator, a 256R voltage divider with analog switches and a successive approximation register. Its 8-channel multiplexer can directly (approach; access) any of 8-single-ended analog signals. The device needs no (external; internal) zero and full-scale adjustments. The (latched; latching) and (decoded; decoding) multiplexer address inputs and latched TTL 3-state outputs provide easy interfacing to microprocessors. ADC0808 is ideally (suited; suiting) to applications from process and machine control to home and automotive control.

II. (18%) Choose one answer which matches the meaning of the given sentence.

3. You don't look your age.
    (A)You look younger than you are.
    (B)You don't think much of your age.
    (C)You seem to be older.
    (D)You are on the right side of twenty.

4. He gives himself up to drinking.
    (A)He has a strong objection to drinking
    (B)He abstains from wine.
    (C)He stops drinking.
    (D)He indulges himself in drinking.

5. He has eyes for me.
    (A)He is jealous of me.
    (B)He is angry with me.
    (C)He is interested in me.
    (D)He envies me very much.

6. We were six days going from St. Louis to St. Joe.
    (A)We were allowed to go from St. Louis to St. Joe in six days.
    (B)We took six days to go from St. Louis to St. Joe.
    (C)Six days later, we went from St. Louis to St. Joe.

(D)We waited six days before we went from St. Louis to St. Joe.

7. Grace was said before dinner.

    (A)They talked about Grace before dinner.

    (B)They asked Grace to say something before dinner.

    (C)They said grace before dinner.

    (D)Grace said she would come back before dinner.

8. The city government spares no efforts to raise the city's cultural level.

    (A)The city government won't raise the city cultural level.

    (B)The city government wastes so much time in raising the city's cultural level.

    (C)The city government makes every effort to raise the city's cultural level.

    (D)The city government doesn't think much of culture, so the city government won't spare any effort to raise the city's cultural level.

III. (36%) Reading comprehension

The first coins to appear in the Western world were issued by theLydians and the Ionian Greeks in the eighth century B.C. These coins, which were made ofelectrum, a natural combination of gold and silver, were irregular in weight and quality and apparently of private issue. The pure gold and silver coins with related values which appeared during the reign of Croesus (560-546 B.C.) provide the first undoubted evidence of standard coinage by state authority. The coins were not perfectly shaped, however, for they were struck with a hand-wielded hammer. The trend toward complete mathematical symmetry did not, in fact, begin until the coining press, invented byLeonardo da Vinci in the sixteenth century, was generally adopted in the middle of the seventeenth century.

One should not assume, however, that only machine-made coins are prized for their workmanship. The silver dekadrachm from Syracuse, struck about 413B.C., is considered one of the finest Greek coins and is worth more than a thousand dollars today. An artistic masterpiece of a much later period is the silvertaler minted in Ratisbon, southern Germany, in 1754.

The value of a coin is not primarily determined by its age, as many people seem to think. Many Greek and Roman coins that were issued in abundance can be purchased for a moderate price. On the other hand, a German coin made of shrapnel during the First World War is very rare and valuable. Among the especially rare United States coins are the 1804 silver dollar, the 1822 five-dollar gold piece, and the 1894silver dime.

9. The reason some old Roman coins are not costly is that they are

    (A) available in quantity

    (B) inferior in workmanship

    (C) irregular in shape and size

    (D) made out of inexpensive metal

10. Which of the following statements may NOT be made about the coins made in Lydia during the reign of Croesus?

    (A) They were issued by the government.

    (B) They were given standard values.

    (C) They were all of equal purity.

    (D) They were all alike in shape.

11. The author specifically mentions all of the following features of theSyracusan dekadrachm EXCEPT its

    (A)appearance

    (B)scarcity

    (C)value

    (D)age

12. Leonardo da Vinci is mentioned in the passage in connection with

    (A) the first government issue of coins

    (B) the artistic aspect of coin making

    (C) coins issued in the sixteenth century

    (D) the production of uniform coins

13. The author makes it clear that the Syracusan dekadrachm and the German taler mentioned in the passage are

    (A) hand-made Western coins

    (B) worth about a thousand dollars each today

    (C) made out of different metals

    (D) noted for their craftsmanship

14. The author emphasizes the importance of which of the following factors in establishing the purchase price of a coin?

    (A) The date of issue

    (B) The country of origin

    (C) The number in existence

    (D) The quality of craftsmanship

15. Which of the following statements about the United States coins mentionedCANNOT be concluded from the passage?

    (A) They are available for immediate purchase.

(B) They were produced by a coining press.

(C) They were produced in small quantities.

(D) They are high-priced collectors' items.

16. The author makes it clear that coins made by machine are

    (A) usually of greater value than hand-made coins

    (B) more uniform in size and shape than hand-made coins

    (C) available in larger quantities than hand-made coins

    (D) generally superior in workmanship to hand-made coins

What can you do if you "lose" the data from your disks? To find an expert, who would recover the lost information for you, is probably the easiest solution. Jack Olson is one of these experts. Jack and a few of his friends set up a company called "Sack's Disk Doctor Service" in 1984. They work from home and give all the money they earn to charity. The fees are always the same, no matter how precious the data on the disk is. Some people, however, are so grateful that they send extra money to Jack or to the charities his company supports. One oil company offered him $2000 for his help and an architect even sent him a blank check.

It would be difficult to put a value on the things rescued by the Disk Doctor. There have been disks containing medical research, television scripts, manuscripts of whole books, a lawyer's papers for a court case, and even Margaret Thatcher's travel plan for a visit to eastern Europe. For this last case, Jack had to go in person to Thatcher's office "for security reasons"!

Disks are usually sent to the Disk Doctor by post, but sometimes people are in such a hurry that they cannot wait for the mail to come. For example, some radio scripts had to be rushed by taxi to Jack's house because they were needed for broadcasting the next day. When the material has been recovered, the disk is returned to the sender with a diagnosis and a prescription for avoiding the problem in the future. One grateful client, an author, put a "thank you" to Jack in the front of his book. "Jack saved me from a heart attack," he wrote. "But, " says Jack, "most people don't take any notice of the doctor's advice!"

17. What does the word rescued in the second paragraph mean?

    (A) Recovered.

    (B) Prescribed.

    (C) Examined.

    (D) Discovered.

18. Why did the architect send Jack a blank check?

    (A) The architect did not have any money.

(B) The architect did it for security reasons.

(C) The architect always followed the doctor's advice.

(D) The architect thought Jack's service was priceless.

19. Which of the following statements is NOT true"

(A)Jack's Disk Doctor Service has only one standard fee.

(B)Jack and his company have made a fortune from their service.

(C) Margaret Thatcher is a very important person.

(D)Jack's clients are from all walks of life.

20. From the statement "But...most people don't take any notice ofthe doctor's advice!" we can infer that:

(A) most people don't lake medicine regularly.

(B) many of Jack's patients would probably get sick again.

(C) many of Jack's clients have sought for his help more than once.

(D) most people don't read the instruction when using a computer.

IV. (22%) General test

Most people like to talk, but few people like to listen. (21)listening well is a rare talent that everyone should treasure. Because they hear more, goodlisteners (22) to know more and to be more sensitive to what is going on around them than other people. In addition, good listeners are inclined to accept or tolerate (23) to judge and criticize. Therefore, they have (24) enemies than other people. (25), they are probably the most loved of people. However, there are (26) to that generality. For example, JohnSteinbeck is (27) to have been an excellent listener, yet he was hated by some of the people he wrote about. No doubt his ability to listen contributed (28) his capacity to write. (29, the results of his listening did not make him popular. Thus, (30) on, what a good listener (31), he may become either popular or disliked in his lifetime.

21. (A)Yet (B)And (C)Or (D)So

22. (A)mean (B)like (C) end (D)act

23. (A) instead of (B) rather than (C) in order (D) in addition

24. (A)little (B)least (C)lesser (D) fewer

25. (A)In contrast (B)In particular (C)In fact (D)In other words

26. (A)situations (B) exceptions (C)perceptions (D)observations

27. (A)called (B)named (C)said (D)told

28. (A)on (B)to (C)for (D)in

29. (A)Nevertheless (B)Conversely (C)Consequently (D)Moreover

30. (A)depend (B)depends (C)depended (D)depending

31. (A)did (B)does (C) was (D) is