I. Choosing the Synonym (40%)

Read the passages. Choose the letter of the word or phrase that is the best answer to the question (or questions) following each passage.

1. Much can be done to halt the process of desertification. For example, an asphalt-like petroleum can be sprayed onto sand dunes, and seeds of trees and shrubs can then be planted. The oil stabilizes the sand and retains moisture, allowing vegetation to become established where the desert had previously taken over.

Desertification is
(A) spraying oil onto sand dunes (B) the planting of trees and shrubs (C) the vegetation becoming established (D) the desert taking over an area

2. Of all the microelectronic devices that engineers have produced, the computer has the greatest potential impact on society. At the heart of every computer, there are microchips. Microchips consist of large collections of devices like the diode and transistor connected on a single piece of silicon.

Diodes and transistors are
(A) computer collections (B) microelectronic devices (C) silicon pieces (D) computer engineers

3. How complicated the preparations for a camping trip are depends on the duration of the trip as well as the isolation of the area in which the camper intends to be. If campers intend to stay at one of the many commercial campsites, most of their needs are provided for. However, if one desires to be far from civilization, choosing camping paraphernalia such as tents, sleeping bags, cooking implements, and other supplies should be done with care.

Paraphernalia is
(A) equipment (B) food supplies (C) sleeping bags (D) campsites

4. In the third century B.C.E, Ctesibuis, the Greek engineer and theorist, first exercised his inventive talents by making an adjustable mirror and then creating
ingenious toys that could move under their own power.

Inventive is
(A) regional (B) creative (C) flexible (D) effective

5. Vitamin D is called the sunshine vitamin because it is absorbed through bare skin. The body uses it to form strong bones, and therefore, it is essential for growing children. People who are not exposed to the sun can become deficient in vitamin D and may develop the bone disease rickets.

Deficient is
(A) overexposed (B) infected (C) lacking (D) improved

When Jessye Norman's parents were knocking on the wall of their young daughter's room as a signal for her to stop singing and to go to sleep, little did they dream that this small child who seemed to have been born singing would grow up to be an internationally renowned opera singer.

It is not surprising that Jessye loved to sing. Music was an integral part of her family's lifestyle. Although Jessye remembers her mother singing spirituals, it was her grandmother who was always singing. Every hour of her day and every mood was highlighted with a song that fit the occasion. As Jessye was growing up, her piano-playing mother and trumpet- and trombone-playing brothers accompanied her when the family was called upon to provide special music for church services, parent-teacher meetings, and ribbon-cutting ceremonies.

During her childhood, Jessye knew only three operatic numbers: one that she learned from a recording and two others the only opera scores she could find at the local music store. Although singing was in her blood, it was not until she attended Howard University that Jessye Norman took her first voice lesson, with Carolyn Grant, who recognized her talent and knew how to channel it. It was almost immediately after leaving the university in 1968, on her first visit to Europe, that Jessye won the singing prize in the International Music Competition of German Radio. The following year, she was invited to go to Berlin to perform at the Deutsche Opera. Since that time, Jessye Norman has become a world superstar whose singular voice reaches audiences all over the world.
6. The word **enowned** in line 4 is closest in meaning to  
   (A) infamous  (B) celebrated  (C) notorious  (D) precocious

7. The word **ntegral** in line 5 is closest in meaning to  
   (A) demanding  (B) persistent  (C) essential  (D) intuitive

8. The word **ighlighted** in line 8 is closest in meaning to  
   (A) emphasized  (B) contradicted  (C) conveyed  (D) belittled

9. The word **cores** in line 13 is closest in meaning to  
   (A) points  (B) experts  (C) voice lessons  (D) sheet music

10. The word **hannel** in line 16 is closest in meaning to  
    (A) station  (B) irrigate  (C) exploit  (D) direct

II. Reading Comprehension: Read the following statements. Circle the letter of the statement that has the same meaning as the given statement. (40%)

11. Fainting is caused by a sudden drop in the normal blood supply to the brain.  
    (A) The brain reacts to a drop in the normal blood supply by fainting.  
    (B) Fainting occurs when the brain suddenly loses its normal blood supply.  
    (C) Fainting happens when the brain drops its normal blood supply.  
    (D) The brain faints when the normal blood supply drops.

12. Gorillas, which are vegetarians, have been observed to demonstrate gentle behavior toward small creatures in the wild.  
    (A) Vegetarians have been observed to demonstrate gentle behavior toward gorillas and small creatures in the wild.  
    (B) Only vegetarian gorillas have been observed as demonstrating gentle behavior toward small creatures in the wild.  
    (C) Small creatures in the wild have been observed as behaving gently and demonstratively when near gorillas.  
    (D) It has been observed in the wild that gorillas, by nature vegetarians, treat small animals gently.

13. In fighting forest fires, the initial attack crews dig a fire line, which varies in width depending on the strength and nature of the fire.
(A) Initial attack crews dig a forest fire to vary the fire line width. (B) Initial attack crews depend on the nature of the fire to vary the fire line. (C) The width of the fire line, which the initial attack crews dig, varies according to the strength and nature of the fire. (D) In digging a fire line, the initial attack crews depend on fighting forest fires.

14. Medical quackery, which promises cures for all existing and even nonexisting diseases, has a powerful appeal even to the well-educated.

(A) Well-educated people in medicine promise to find a powerful cures for diseases. (B) Even well-educated people are attracted to fake cures for diseases that may or may not exist. (C) Medical quackery promises the well educated a cure for diseases. (D) The medical profession has appealed to the well educated for funding to find cures for diseases.

15. A silver compound has been found to kill the parasitic protozoa that are carried by the dreaded tsetse fly and cause sleeping sickness.

(A) The dreaded tsetse fly causes sleeping sickness and kills the parasitic protozoa used for finding silver compounds. (B) It has been found that the silver compound that is carried by the dreaded tsetse fly and causes sleeping sickness kills the parasitic protozoa. (C) Sleeping sickness, which is caused by the dreaded tsetse fly, has been found to kill the parasitic protozoa in silver compounds. (D) Parasitic protozoa that cause sleeping sickness and are carried by the dreaded tsetse fly can be killed with a silver compound.

16. While working as a postmaster at the University Of Mississippi, William Faulkner submitted thirty-seven stories to magazines, six of which were accepted.

(A) Of the thirty-seven stories that Faulkner wrote while working at the University Of Mississippi as a postmaster, six became published in magazines. (B) Faulkner wrote six out of thirty-seven stories after accepting a job as postmaster at the University Of Mississippi. (C) Faulkner published thirty-seven stories in magazines, six of which were accepted by the University Of Mississippi. (D) The six accepted stories by Faulkner were about his job as a postmaster at the University Of Mississippi.

17. The continental drift theory proposes that the earth crustal plates are driven by a global system of convection currents in the hot magma below that behave like giant
conveyor belts.
(A) Theoretically, the earth crustal plates behave like giant conveyor belts, driving the convection currents across the hot magma, which causes the continents to drift. (B) A global system of convection currents in the underlying hot magma acts as giant conveyor belts to drive the earth crustal plates. (C) The continental drift theory suggests that global plates cover hot magma, which acts as a giant conveyor belt below the convection currents. (D) The continental drift theory is proposed by the earth crustal plates, which drive a global system of convection currents in the hot magma below, behaving like giant conveyor belts.

18. Medical authorities have been reluctant to support the findings of some nutritionists that vitamin C given in large doses can prevent the common cold.
(A) Medical authorities support the nutritionists' views about the value of vitamin C in preventing the common cold. (B) Nutritionists have found that medical authorities are not in favor of using vitamin C to prevent the common cold. (C) Some nutritionists have found that large doses of vitamin C can prevent the common cold, but this has not been completely accepted by medical authorities. (D) According to nutritionists and some medical authorities, the common cold can be prevented by giving large doses of vitamin C.

19. Female cowbirds, which cannot sing, are nonetheless able to teach songs to their young by responding to specific chirps and ignoring others.
(A) Even though female cowbirds cannot sing, they teach their chicks to do so by responding to specific chirps and ignoring others. (B) Female cowbirds can neither sing nor teach songs to their babies by responding to certain chirps more than to others. (C) Female cowbirds, which cannot sing, have certain other birds teach their young to sing. (D) Female cowbirds, which cannot sing, unsuccessfully attempt to teach their young to sing by responding to other bird songs.

20. The conflict between those who wish to conserve a large area of unaltered and unimproved spaces and those who want the abolition of the last remnants of wilderness in the interest of industrial profit will not be resolved in the near future.
(A) The people who desire to conserve a large area of untouched natural land and those who want to use all land for industrialization are in a conflict that will not have an immediate resolution. (B) The conflict over whether a large area of unaltered and
unimproved space should be given over for industrial development and profit is of interest to those resolved to abolish the last remnants of wilderness. (C) Lawyers are profiting from the unresolved conflict between the people who wish to save the last remnants of wilderness and those who want to alter and improve the space for industry. (D) There is an unresolved conflict caused by people who wish to abolish industry and turn the spaces back into a natural wilderness state.

III. Choose the answer that can best complete the sentence. (20%)

21. By far, _______ of Saudi Arabia is oil.
(A) it is the most important export (B) the most important export is (C) that is the most important export (D) the most important export

22. Yellowstone National Park attractions include the famous Old Faithful geyser, vast forests, plentiful wildlife, and _______.
(A) campgrounds are well maintained (B) campgrounds are maintained well (C) maintains campgrounds well (D) well-maintained campgrounds

23. _______ often serve as places of public entertainment and festivals, they can also be places where people can find peace and solitude.
(A) Even though city parks (B) City parks (C) City parks that (D) There are city parks which

24. A fine tomb, _______, marks the grave of the poet Chaucer.
(A) which in the fifteenth century was erecting (B) erected in the fifteenth century (C) erecting in the fifteenth century (D) being erected in the fifteenth century

25. _______ perhaps the most awe inspiring among the great structures of the world.
(A) The Great Wall of China (B) The Great Wall of China which is (C) The Great Wall of China is (D) That the Great Wall of China is
請按次序作答

1. (10%) 解 $\int t^2 \sin(3t) \, dt$

2. (10%) 解 $\frac{dy}{dx} = \frac{xy}{2x^2 + 3y^2 - 20}$

3. (10%) 解 $y'' - 2y' - 3y = 4x - 5 + 6xe^{2x}$.

4. (10%) 解 $y'' + 4y' + 13y = \delta(t - \pi) + \delta(t - 3\pi)$, $y(0) = 1, y'(0) = 0$

5. (20%) 解 $X' = \begin{pmatrix} 4 & -5 \\ 5 & -4 \end{pmatrix} X$

6. (20%) 以級數(series)法解 $9x^2y'' + 9x^2y' + 2y = 0$，請寫出各前五項非零之係數

7. (20%) 求函數 $f(x) = \begin{cases} 0 & , -\pi < x < 0 \\ \sin(x) & , 0 \leq x < \pi \end{cases}$ 的 Fourier 級數
1. Please describe these nouns: (a) intrinsic semiconductor, (b) donor, (c) acceptor, (d) diffusion current, and (e) minority carrier for Si MOSFET.

2. (a) Please draw the $i_C - v_{CB}$ characteristic of Silicon-BJT, and describe the detail region in this curve. (b) Please draw the small-signal model for this BJT.

3. Consider the FET amplifier of Fig. 1 for the case $V_t = 2V$, $k_n(W/L) = 1 \text{ mA/V}^2$, $V_{GS} = 4V$, $V_{DD} = 10V$, and $R_D = 3.6K \Omega$. (a) Calculate the value of $g_m$ at the bias point and (b) the voltage gain.

4. (20%) A series-shunt feedback amplifier employs a basic amplifier with input and output resistances each of 1k\(\Omega\) and gain $A = 2000V/V$. The feedback $\beta = 1V/V$. Find the gain $A_f$, the input resistance $R_{in}$, and the output resistance $R_{out}$ of the closed-loop amplifier.

5. Design the LCR resonator of Fig. 2 to obtain natural modes with $\omega_0 = 10^7 \text{ rad/s}$ and $Q = 2$. Using $R = 10k\Omega$. 

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**Fig. 1**

**Fig. 2**
1. A uniform solid disk of mass 3.00 kg and radius 0.200 m rotates about a fixed axis perpendicular to its face. If the angular frequency of rotation is 6.00 rad/s, calculate the angular momentum of the disk when the axis of rotation (a) passes through its center of mass and (b) passes through a point midway between the center and the rim. \( I_{CM} = \frac{1}{2} mR^2 \)  

2. Please use Newton’s second law to prove that the period and frequency of simple pendulum depend only on the length of string and the gravity acceleration if the angle \( \theta \) from the vertical is so small that the approximation \( \sin \theta = \theta \) holds.  

3. Two sinusoidal waves traveling in opposite directions interfere to produce a standing wave with the wave function \( y = (1.50 \text{ m}) \sin(0.400x) \cos(200t) \) where \( x \) is in meters and \( t \) is in seconds. Determine the wavelength, frequency and speed of the interfering waves.  

4. An insulating solid sphere of radius \( a \) has a uniform volume charge density \( \rho \) and carries a total positive charge \( Q \). The radius \( r \) is the distance from the center of the sphere. Please use Gauss’s law to (a) calculate the magnitude of the electric field at a point outside the sphere \(( r > a )\), and (b) find the magnitude of the electric field at a point inside the sphere \(( r < a )\).  

5. The figure shows a simple RC circuit. Let us assume that the capacitor in this circuit is initially uncharged. There is no current while the switch is open. If the switch is closed at \( t = 0 \), charge begins to flow and the capacitor starts to charge. Please use the appropriate loop equation to derive the current as a function of time. 

\begin{figure}[h]
\centering
\includegraphics[width=0.2\textwidth]{rc_circuit.png}
\caption{Simple RC circuit}
\end{figure}