

(Time: 3 hours)

Max Marks: 80

Note: (1) Question No. 1 is Compulsory.

(2) Answer any three questions from Q.2 to Q.6.

(3) Figures to the right indicate full marks.

Q1.

- a) Solve: $\frac{dy}{dx} = \frac{\tan y - 2xy - y}{x^2 - x \tan^2 y + \sec^2 y}$ **5**
- b) Solve: $[(D - 2)^2(D + 1)]y = e^{2x} + \sin 3x$ **5**
- c) Using Euler's method find $y(0.5)$ for $\frac{dy}{dx} = 1 + xy$; $y(0) = 1$ with $h = 0.1$, correct up to 3 decimal places. **5**
- d) Change the order of Integration for $I = \int_0^5 \int_{2-x}^{2+x} f(x, y) dy dx$ **5**

Q2.

- a) Solve: $(D^3 - 4D + 4)y = x^2 + \cos 2x$ **6**
- b) Solve: $x \frac{dy}{dx} + (1 + x)y = e^x$ **6**
- c) Evaluate $I = \int_0^3 \frac{dx}{1+x}$ using **8**
 1) Simpson's 3/8th rule 2) Simpson's 1/3rd rule 3) Trapezoidal rule.

Q3.

- a) Using DUIS rule show that $\int_0^\infty \frac{\tan^{-1}(ax)}{x(1+x^2)} dx = \frac{\pi}{2} \log(1+a)$ **6**
- b) Evaluate $\iint y dx dy$ over a region bounded by $y = x^2$ and $x + y = 2$ **6**
- c) Evaluate: $I = \int_0^2 \int_0^x \int_0^{2x+2y} e^{x+y+z} dz dy dx$ **8**

Q4.

- a) Find using double integration the area inside the circle $r = a \sin \theta$ and outside the cardioid $r = a(1 - \cos \theta)$ **6**
- b) Using Runge-Kutta Method of order four find $y(0.1)$ for $\frac{dy}{dx} = \sqrt{x+y}$; $y(0) = 1$ with $h = 0.1$, correct up to 3 decimal places. **6**
- c) Show that: $\int_0^{\infty} x^2 e^{-x^4} dx * \int_0^{\infty} \frac{e^{-x^2}}{\sqrt{x}} dx = \frac{\pi}{4\sqrt{2}}$ **8**

Q5.

- a) Evaluate $I = \iiint (x^2 y^2 + y^2 z^2 + z^2 x^2) dx dy dz$ throughout the volume of the sphere $x^2 + y^2 + z^2 = a^2$ **6**
- b) Solve: $(x \sec^2 y - x^2 \cos y) dy = (\tan y - 3x^4) dx$ **6**
- c) Solve by method of variation of parameter $(D^2 + 9)y = \frac{1}{1 + \sin 3x}$ **8**

Q6.

- a) Using modified Euler's method find $y(0.2)$ for $\frac{dy}{dx} = x - y^2$; $y(0) = 1$ with $h = 0.2$, correct up to 3 decimal places. **6**
- b) Find the length of the cardioid $r = a(1 + \cos \theta)$ which lies outside the circle $r + a \cos \theta = 0$ **6**
- c) Change into polar coordinates and evaluate **8**

$$\int_0^{a/\sqrt{2}} \int_y^{\sqrt{a^2 - y^2}} \log(x^2 + y^2) dx dy$$

Correction in **1T01832** - F.E.(SEMII)(ALL BRANCHES) (Rev - 2019 C Scheme) / **29711** - Engineering Mathematics – II

Q.P. Code: **10054518**

Q.2 a) Read as Solve: $(D^2 - 4D + 4)y = x^2 + \cos 2x$ instead of D^3

Time: 2 Hours

Maximum Marks: 60

- N.B**
- i) Question number 1 is compulsory
 - ii) Attempt any three questions from Q2 to Q6
 - iii) Assume suitable data wherever required
 - iv) Figures to the right indicate full marks for that question
- Q1** **Attempt any five out of six (3 marks each)** **15**
- A What is a grating element? How is the condition for absent spectra obtained in a grating? Which spectra will be absent when the width of the opaque region is twice that of the transparent region? **3**
 - B What is a resonant cavity? Explain its use in the generation of Laser beams. **3**
 - C With the help of a diagram define the term acceptance angle. Calculate the acceptance angle for an optical fibre with 1.48 and 1.42 as the refractive indices of core and cladding respectively. **3**
 - D Find the gradient at a point (1, -1, -2) for a scalar field $A = \frac{1}{2}(x^3y - xy^2)$. **3**
 - E With what velocity should a rocket move, so that every year spent on it corresponds to 2.5 years on the earth? **3**
 - F What is a sensor? What is calibration? Why is it necessary to calibrate a sensor? **3**
- Q2** **Attempt both the questions** **15**
- A Discuss with diagram the phenomenon of Fraunhofer diffraction at a single slit and write the conditions for its maxima and minima. **8**
(5+3)

Find the order of diffraction if a diffraction grating is used at normal incidence for a line 'A' of wavelength 5600 Å in a certain order being superimposed on another line 'B' of the next higher order having wavelength 4200 Å. Now if the angle of diffraction for the line A is 45°, then how many lines per cm are there in this grating for the above obtained order?
 - B With the help of a neat labelled diagram explain the two types of fibres, categorised on the basis of refractive index. How does a ray of light travel in these fibres? **7**
(4+3)

What is the significance of the 'V' number? A multimode step index fibre with core RI 1.53 and cladding RI 1.50 has a core radius of 10 micrometre. Calculate the normalised frequency of the fibre and the number of guided modes at an operating wavelength of 7000 Å.
- Q3** **Attempt both the questions** **15**
- A What are scalar and vector fields? Give examples. Explain the term 'curl of a vector' and state its significance. **8**
(4+4)

Show that the divergence of the curl of a vector is zero.
 - B With neat and labelled diagrams explain the construction and working of a semiconductor laser. Give its application. **7**

- Q4** **Attempt all three questions (5 marks each)** **15**
- A** What do you understand by resolving power? Illustrate by drawing a neat diagram. How can the resolving power of a grating be increased? **5**
Find maximum order of diffraction if a grating having 6000 lines per cm is illuminated by a laser beam of wavelength 6000 Å.
- B** What is the divergence of a vector field? Give its physical significance. **5**
Find the divergence of a field $F = xz \hat{i} + y^2z^3 \hat{j} - xyz \hat{k}$ at a point (1, -1, 1). Interpret the result you obtain.
- C** Recall the term Nanotechnology. How are the nanomaterials classified on the basis of their dimensions? What are the applications, advantages and disadvantages of nanotechnology? **5**
- Q5** **Attempt all three questions (5 marks each)** **15**
- A** What is length contraction? Express it mathematically. **5**
The length of a moving rod is found to be one third of its length when at rest. What is the speed of the rod relative to the observer?
- B** With a neat labelled diagram explaining the construction and working of an atomic force microscope. List its advantages over an electron microscope. **5**
- C** With a neat labelled diagram explain the construction and working of a Piezoelectric Ultrasonic Transducer. **5**
- Q6** **Attempt all three questions (5 marks each)** **15**
- A** Explain Gauss's laws for static electric and static magnetic fields in differential and integral forms. **5**
- B** Explain the two main types of approaches used to synthesise a nanomaterial. Discuss in detail any one method with reference to the bottom up approach. Give the advantage of this method over other methods. **5**
- C** With a neat labelled diagram explain the construction and working of a Photodiode as an optical sensor. **5**
-

Time: 2 hours

Max. Marks 60

- N.B. 1. Question No.1 is compulsory.
 2. Attempt any three from Q.2 to Q.6
 3. Draw a neat diagram and write chemical reactions where necessary.

Q.1 Atomic weights: H = 1, C = 12, N = 14, O = 16.

- Define octane number, knocking and cetane number.
- Differentiate between Galvanizing and Tinning.
- Explain the principle "Design degradable products" of green chemistry.
- What are the energies associated with molecule that are useful for its spectroscopic study?
- Define Standard Electrode potential, Reference electrodes, Electrolytic Cell.
- Why does aluminium even though placed higher in galvanic series show extra resistant to corrosion?
- A coal sample was subjected to ultimate analysis. 3 g of coal sample on combustion in bomb calorimeter produced 0.45g of BaSO₄. Calculate the % of sulphur.

Q.2 a What is Electrochemical corrosion? Explain the mechanism of Electrochemical corrosion by the evolution of hydrogen. 6

b Calculate higher and lower calorific value of coal sample containing C-90%, O-5%, H-8%, S-1.5%, N=5% and the remaining is ash. 5

Explain conventional and greener pathways for the synthesis of Carbaryl.
 Highlight the Green Chemistry principle involved.

c What are anti-knocking agents? Write a note on unleaded petrol and role of catalytic converter. 4

Q.3 a Define corrosion and explain the basic reason due to which, most of metals corrode. 6
 How does following factors affect rate of corrosion?

- pH
- Relative areas of anodic and cathodic part of metal.

b Explain conventional and greener pathways for the synthesis of Carbaryl. Highlight the Green Chemistry principle involved. 5

c Write the cell reactions and calculate standard emf of the following reaction: 4

$Zn/Zn^{2+} (aq, 1M) // Ag^+ (aq, 1M) / Ag(s)$. Calculate the emf of the cell at 25°C.

Given: $E^0_{Zn/Zn^{2+}} = -0.73 V$ and $E^0_{Ag^+/Ag} = +0.83 V$

Q.4 a Calculate the volume and weight of air required for complete combustion of 1m³ of 6

gaseous fuel having the following composition: CO = 10%, C₂H₄ = 4%, CH₄ = 35%, N₂ = 2%, H₂ = 45%, CO₂ = 2%, Remaining Ash. (Molecular weight of air = 28.949).

b What is Biodiesel? Give transesterification reaction in the preparation of biodiesel. 5

Also write the advantages of biodiesel.

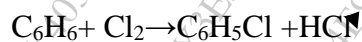
c Explain Intergranular corrosion with the help of a diagram. 4

Q.5 a What is Fluorescence and phosphorescence? Explain the phenomena of 6

Fluorescence and phosphorescence with the help of Jablonski diagram.

b Calculate the percentage atom economy for the following reaction with respect to 5

acetanilide.



Given Atomic Weights: C = 12, H = 1, O = 16, Cl = 35.5

c Explain impressed current cathodic protection of corrosion control. 4

Q.6 a What is an electrochemical cell? Give construction and working of Standard 6

Hydrogen Electrode with the help of diagrams and reactions.

b 2.5 g of coal sample was taken in a silica crucible and heated in an oven maintained 5

at 110⁰ C for one hour. The weight after heating was 2.41g. The same sample was analysed for volatile matter and the weight obtained was 1.98 g, the sample was further heated to get the fixed weight of 0.246 g. Calculate the percentage results of the above analysis.

c What is the selection rule? Distinguish between allowed and forbidden transition. 4

Time: 3 Hours

Max. Marks: 60

General Instructions:

1. Solve any four questions.
2. All dimensions are in mm.
3. Use first angle method of projection.
4. Assume suitable dimension if it is necessary.

- Q1. a.) One end of a string of length 115 mm is fixed on a point on the circumference of a Disc of diameter 40 mm. The string is wound around the disc, keeping the string always tight. Draw the curve traced by the other end of the string. Name the curve also. 6
- b.) The pictorial view of a machine part is shown in figure 1. Draw 4
- i) Front view from A 4
 - ii) Top view 1
 - iii) Insert at least 6 Dimensions.

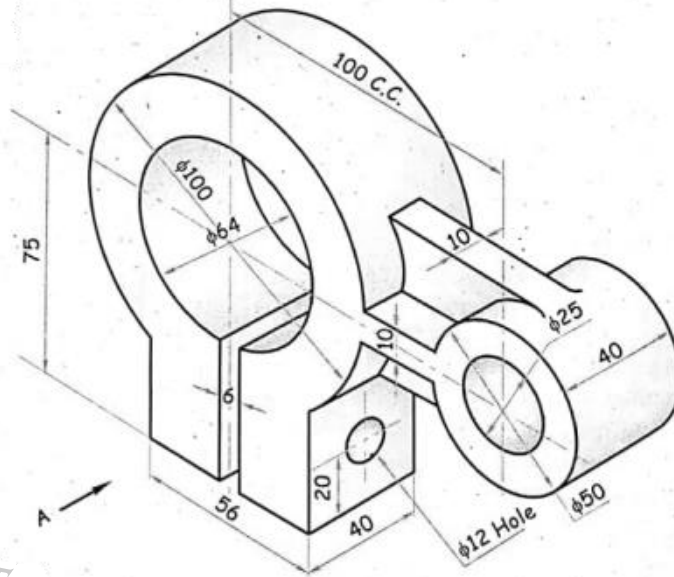


Figure 1

- Q2. A hexagonal pyramid side of base 30 mm and axis 60 mm long stand on an edge of base on HP with its apex being 45mm above HP. Draw the projections of the pyramid when the edge on HP makes an angle 45 degrees with VP. 15

Q3

Following figure 2 shows the pictorial view of an object. Draw

i) Sectional front view along section A-A

ii) Top view.

iii) Right hand Side view

Insert at least 10 dimensions

5

4

4

2

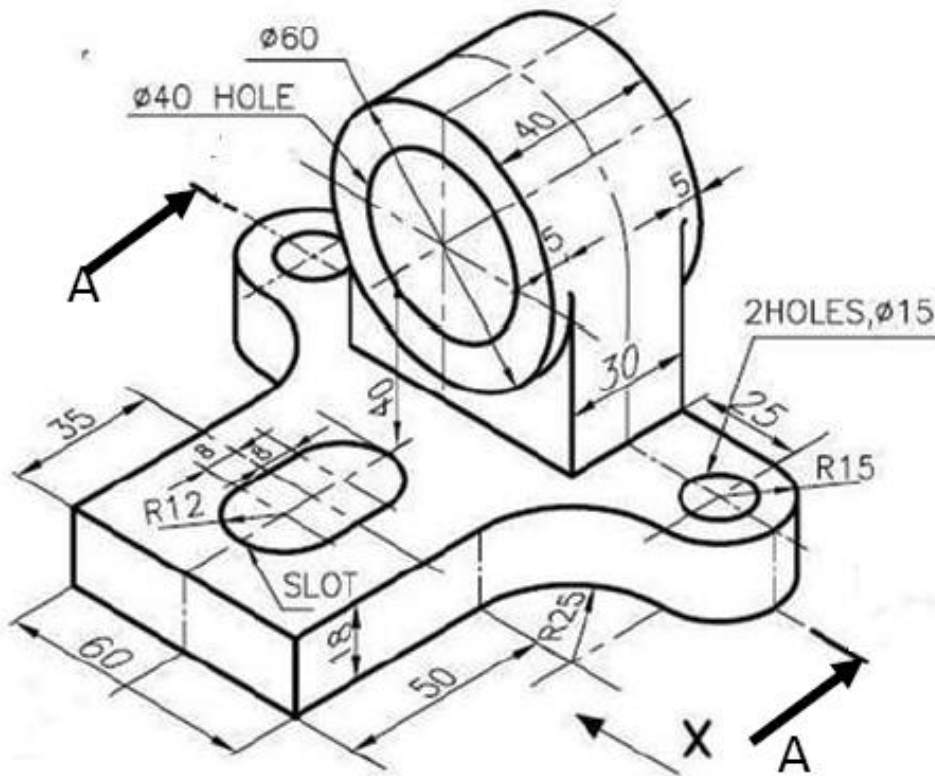


Figure 2

Q4

A right circular cone of diameter 60 mm and axis 75 mm is lying on HP on its curved surface. It is cut by horizontal section plane such that the true shape of the section is a parabola with axis equal to 50 mm. Draw Sectional TV, FV showing section plane and indicate the true shape of the section.

15

Q5.

a) A pentagonal prism side of base 30 mm and axis length 60 mm has its base edge on HP and the base is inclined 45 degrees to HP. Draw projections of the prism.

6

- b) Figure 3 shows the front view and top view of an object. Draw its isometric view. 9

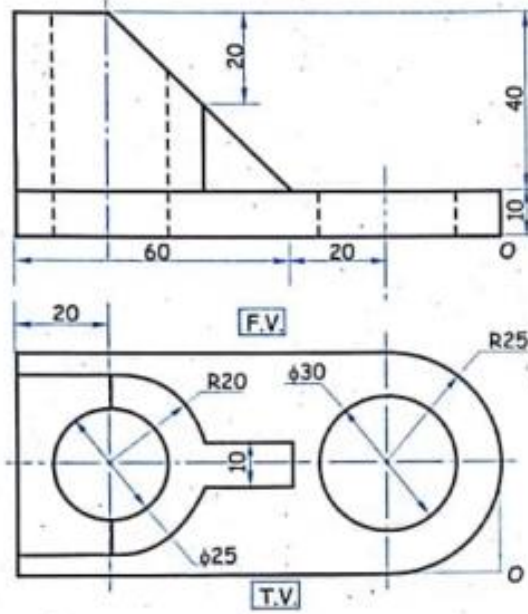


Figure 3

- Q6 a) One end "P" of the line PQ is 10mm above HP and 25mm in front of VP. The FV of the line measures 50mm and inclines 50 degrees to XY line. Draw projections of the line and find its inclination with HP and VP if the true length of the line is 75 mm. Consider the line being in first quadrant only. 9
- b) Draw the isometric view of the given views in figure 4. 6

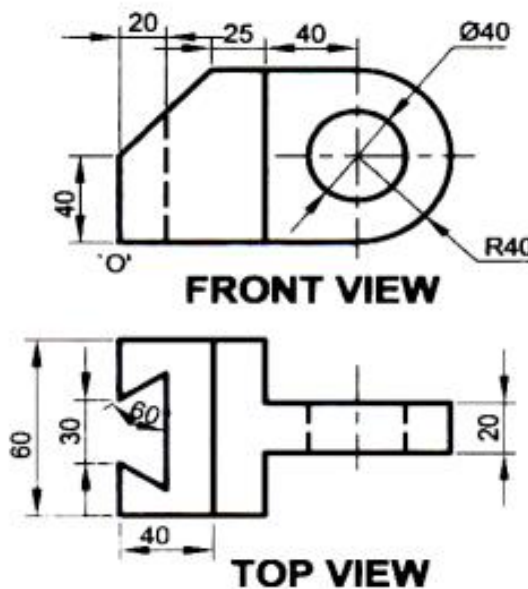


Figure 4

Time: 2 Hours

Max. Marks: 60

- NB: 1) Question No.1 is compulsory.**
2) Attempt any three questions from question no. 2 to 6.

- Q1 Solve any three out of the following. 15**
- A Write a C program to get age and vaccination details as input. Print “senior citizen and eligible for booster” if age > 60 and vaccination input as ‘2’, otherwise print “below 60 and eligible for vaccination”. Use conditional operator. 05**
- B Write string handling functions in C used to do following task: 05**
- If first name, middle name, last name given as an input display it as a full name.
 - Display number of characters in full name.
 - Convert first name into capital letters and last name into small letters.
 - print the full name in reverse order
- C Write a program to print following pattern for given number of rows. 05**
- ```

1
2 2
3 3 3
4 4 4 4
5 5 5 5 5

```
- D Differentiate between Structure and Union. 05**
- E Explain formal parameters and actual parameters with an example. 05**
- Q2 15**
- A What is the purpose of switch statement and write a C program to input an alphabet and check whether it is vowel or consonant using switch case. 05**
- B Write a C program using function to check if the entered number is prime number or not. 05**
- C What is an identifier (variable)? What are the rules to construct identifier (Variable)? Classify the following as valid/invalid Identifiers. 05**
- i) num2    ii) \$num1    iii) +add    iv) a\_2
- Q3 15**
- A Write a C program that takes three coefficients (a, b and c) of a quadratic Equation; ( $ax^2+bx+c=0$ ) as input and compute all possible roots and print them with appropriate messages. 10**
- B Define array. Write a C program to find the sum and average of n integer numbers using array. 05**

**Q4**

- A** What is nested Structure? Explain with proper example. **15**  
**05**
- B** Explain pointer operators with proper example. **05**
- C** Write a C program to replace all occurrences of a character with another in a string. **05**

**Q5**

- A** Write a program to calculate power of a number(x raised to n), accept value of x and n from the user. **15**  
**05**
- B** What is the necessity of parameter passing to function? What are the two ways of parameters passing to function? Explain any one in detail. **05**
- C** Give the difference between break and continue with an example. **05**

**Q6**

- A** Write a C program to find sum of principal diagonal elements of a given square matrix. **15**  
**05**
- B** Define Recursive function. Write a Program to find GCD of two numbers using Recursive function. **05**
- C** Define pseudocode. Draw flowchart and write a pseudocode to find whether given number is palindrome or not **05**

---

Duration: 2 Hours

Total Marks: 40

**NB: Q1. is compulsory.**  
**Attempt any three out of the remaining five questions.**  
**The figures to the right indicate full marks.**  
**Answers to the sub-questions should be grouped together.**

**Q1. Answer the following questions: 10Marks**

- a) Write two advantages of written communication? **2**
- b) Define SQ3R method. **2**
- c) Define Kinesics. **3**
- d) Differentiate between upward and downward channels of communication. **3**

**Q2. Answer the following questions: 10Marks**

- a) You purchased a cell phone online. However you received the package in damaged condition. Write a letter of complaint seeking adequate compensation. **6**
- b) What is meant by communication? Explain the process of communication with the help of a diagram. **4**

**Q3. Answer the following questions: 10Marks**

- a) Identify the barrier in the following sentences: **4**
  - i) A Russian not able to carry a dialogue with an Australian who is on visit to Russia.
  - ii) A successful businessman not accepting the ideas of a salesman who comes to him with new product.
  - iii) Mayur requested Sneha to stop telling the story because he was feeling sleepy.
  - iv) I drafted the message and clicked the 'SEND' button but the message sending failed because the server was down.
- b) Explain any four C's of Business Communication. **4**
- c) Short note on "You Attitude" **2**

**Q4. Answer the following questions: 10Marks**

- a) Your housing society has 100 flats. In General Body Meeting it has been decided to color buildings. As the society write a letter of enquiry and ask for quotation from a local consultant. **6**
- b) Describe any one of the following objects with definition, diagram, description of parts and working : i) Computer or ii) Cell Phone **4**

**Q5. Answer the following questions: 10Marks**

- a) Write short note on -
  - (i) Paralanguage (ii) Mechanical barrier (iii) Grapevine communication **6**
- b) Explain Skimming and Scanning with reference to reading skills. **2**
- c) Difference between warning and caution. **2**

**Q6. a. Answer the following questions:****5**

Read the following passage and answer the following questions:

Chemical fertilizers production is one of the most important investments in agriculture. Plants require sixteen elements in order to grow. Three of these, carbon, hydrogen and oxygen come from air and water; the other thirteen are found in the soil. The primary nutrients among these thirteen elements are nitrogen, phosphorus and potassium. They are consumed in large amounts and are present in all complete fertilizers. Calcium, magnesium and sulphur are the next in the order of importance and for plant growth. The rest of the elements are called micronutrients since they are required only in small quantities. They include zinc, boron, copper, manganese, molybdenum and chlorine.

These sixteen elements are needed every day, by every plant that grows. But the proportions vary with different plants. Cotton requires one recipe, rice another. Different quantities of the elements are consumed at various times. For instance, in the seeding stage a cotton plant requires only a small amount of all the sixteen elements; during the period of rapid growth the plant needs larger amounts of elements, especially more nitrogen; finally, during the fruiting stage the plant needs more phosphorus because phosphorus is concentrated in the seed. If any element needed at any given time is in short supply, even though all the others are present, the deficiency limits the plant's growth in exact relation to the shortage. To correctly apply fertilizers, it is therefore first necessary to analyze the soil in which a crop is to be planted so that the proper combination of elements is added to make up the particular deficiencies of the soil at that place.

In India, there is widespread deficiency of nitrogen. Nearly seventy-five percent of our soils are short of phosphorus and twenty-five percent are short of potash. Our problem is not only to maintain the current fertility of the soil, which is poor, but to enrich it.

Man has been taking nutrition away from the soil for thousands of years all over the world. India is not by any means the only country with depleted soils but it is still one that returns to the soil far less than many other nations. While India's fertilizer consumption per acre of agricultural land is one kilogram, in France it is 27.17 kilograms, in West Germany 65 kilograms, in the Netherlands 82.24 kilograms, in Japan 94.61 kilograms and even in the little used soils of the United States, where man has farmed for food on a large scale for less than 400 years, the input of fertilizer is 6.74 kilograms per acre.

There are three main reasons why Indian farmers use so few fertilizers and they are all complementary. Present farming practices are still, on the whole, strictly traditional and farmers do not know of the advantages of chemical fertilizers. Even if they did, chemical fertilizers are in short supply and expensive; there is insufficient Indian production and a large amount of our fertilizers have to be imported. The machinery needed to set up fertilizer plants has to be largely imported too and it is extremely expensive. So producing fertilizer is a very costly affair initially, but on the other hand, not producing it, and importing food and fertilizer is even worse.

- |                                                                                           |          |
|-------------------------------------------------------------------------------------------|----------|
| a) What are the sixteen elements which the plants require in order to grow?               | <b>1</b> |
| b) Why some elements are called 'micronutrients'? What are they?                          | <b>1</b> |
| c) What is the effect of a deficiency of a particular element on the growth of the plant? | <b>1</b> |
| d) Why is it necessary to analyze the soil before using fertilizers?                      | <b>1</b> |
| e) What is the nature of the soil in India?                                               | <b>1</b> |

**Q6 b. Write step wise instructions to use Microwave oven.**

**5**