K. J. Somaiya Institute of Engineering & Information Technology

Department of Basic Sciences & Humanities

SUBJECT: MATERIAL CHEMISTRY

COURSE CODE: 1UBSC203

Question Bank

F.Y B.Tech.Sem II

AY: 2021-22

Sr. No	Questions of Module "Polymers"	CO
	5 Marks Questions of Polymer	
1	What are bio polymers? How are they classified ? Give examples of some bio polymers.	1
2	What are the characteristics of biomedical polymers? Write applications of 02 biomedical polymers.	1
3	What are Engineering polymers? Write properties and applications of 3 Engineering polymers.	1
4	What are liquid crystal polymers? Write their applications.	1
5	What is fabrication of plastics? With a neat diagram explain in detail Compression moulding of plastics.	3
6	What is fabrication of plastics? With a neat diagram explain in detail transfer moulding of plastics.	3
7	What is fabrication of plastics? With a neat diagram explain in detail extrusion moulding of plastics.	3
8	What is fabrication of plastics? With a neat diagram explain in detail injection moulding of plastics.	3

9	A polymer has the following composition: 10% molecules of molecular weight 2200, 20% molecules of molecular weight 3500, 30% molecules of molecular weight 4100 and 50% molecules of molecular weight 6000. Calculate the number and weight average of molecular weight and polydispersity index.	1
10	What is the structural requirement of the conducting polymers? How are they classified and where they are used?	1
11	A polymer has following composition: 100 molecules of molecular weight 2000, 200 molecules of molecular weight 2500,300 molecules of molecular weight 3000 and 500 molecules of molecular weight 5000.Calculate the number and weight average of molecular weight and polydispersity index.	1
12	A polymer has following composition:10 molecules of molecular weight 2500, 200 molecules of molecular weight 3500, 350 molecules of molecular weight 4000 and 600 molecules of molecular weight 5000. Calculate the number and weight average of molecular weight and polydispersity index	1
13	Define the glass transition temperature and write the factors which affect the glass transition temperature.	1
	3 Marks Questions of Polymer	
1	Explain polymer blend with some examples.	1
2	Explain polymer alloy with some examples.	1
3	What are the requirements of smart polymers and where are they used?	1
4	What are liquid crystal polymers and what are their applications?	1
5	What are the functions of plastsizers? Write examples of plasticizers.	3
6	What is the roll of fillers during moulding operation? Which substances are used as fillers?.	3
7	Distinguish between thermoplastics and thermosetting plastic.	1
8	Why the transfer moulding is better than compression moulding?	3
9	What does mean by viscoelasticity of polymers?	1
10	Explain in brief blown film extrusion moulding.	3

	Questions of Module "Composite Materials"	
	5 Marks questions of Composite Materials	
1	What are large particle reinforced composite materials? Outline their properties with examples.	1
2	What are fiber reinforced composite materials? Mention some important fiber reinforced composite materials with properties and applications.	1
3	What are laminar composites ? What are their applications ?Explain with the help of suitable diagram..	1
4	What are sandwich panel composites ?Where they are used? Explain with the help of suitable diagram..	1
5	How the fiber reinforced composite materials are processed by pultrusion process? Explain with a neat diagram.	3
6	How the fiber reinforced composite materials are processed by filament winding process? Explain with the help of a neat diagram.	3
7	How the fiber reinforced composite materials are processed by prepreg process? Explain with the help of a neat diagram.	3
8	What are the applications of composite materials in different Engineering fields.	1
	3 marks questions of Composite Materials	
1	Write the classification of composite materials.	1
2	What are the characteristics properties of composite materials?	1
3	What do you understand by matrix and dispersed phase? Which are the materials used to make these phases?	1
4	What are whiskers? What are their special properties?	1
5	What are the functions of matrix phase?	1
6	How the dispersion strength particle reinforced particle reinforced composite material get the strength? Explain with examples.	1

	5 Marks Questions of Alloys, Ceramics and Powder Metallurgy	
1	What is alloy and what are the purposes of making alloys?	1
2	Explain effects of the any 5 of the elements on the properties of the alloy steel. Cr, Co, Mn, Ni, Mo, Si, V	1

3	How the corrosion resistant steel is classified? Write composition, properties and applications of each type of corrosion resistant steel.	1
4	What is shape memory alloy? Write its applications.	1
5	What are the applications of powder metallurgy?	1
6	How are ceramics produced? Explain general methods with examples.	1
7	What are ceramics? State their advantages and applications.	1
8	What is powder metallurgy? How are metal powders prepared by process of reduction?	3
9	What is powder metallurgy? List various steps involved in powder metallurgy. Mention the aim of each step.	3
10	What is powder metallurgy? Explain powder injection moulding method of compaction.	3
11	What is powder metallurgy? Explain cold isostatic/hot isostatic pressing method of compaction.	3
	3 Marks Questions of Alloys, Ceramics and Powder Metallurgy	
1	How are plain carbon steel classified based on carbon content? Write down the properties.	1
2	What are limitations of plain carbon steels?	1
3	What are alloy steels? What are the main purposes of making alloy steel?	1
4	What are the advantages of non-ferrous alloys over ferrous alloys?	1
5	Write the composition, properties and uses of Duralumin or Magnalium or Commercial brass or German silver or Gun metal or high phosphorus bronze or Tinman's solder or Wood's metal.	1
6	Nichrome comes under which category of alloy steel? Write types and applications of Nichrome.	1
7	Distinguish between brass and bronze.	1
8	How are plain carbon steel classified based on carbon content? Write down the properties.	1
9	What are the drawbacks of plain carbon steel?	1

10	What are the advantages and limitations of shape memory alloys?	1
11	How is alumina/silicon carbide produced?	1
	5 Marks Questions of Phase Rule	
1	What is Gibb's phase rule? Define and explain terms involved in the phase rule equation with examples.	2
2	Apply Gibb's phase rule to one component system water.	
3	What is the condensed phase rule? Apply it to two component Pb-Ag system.	2
3	What are the advantages and limitations of phase rule?	2
	3 Marks Questions of Phase Rule	
1	An alloy of tin and lead contains 80% tin. Find the mass of eutectic in 1 kg of alloy if the eutectic contains 64% of tin ?	2
2	An alloy XY of 10 gm weight contains 35% of X. The molten XY on cooling gave out Y and a eutectic alloy with X and Y with equal percentage. What is the amount of Y that has been formed?	2
3	500 kg of sample of argentiferrous lead containing 0.1% silver is melted and then allowed to cool. If eutectic contains 2.7% of silver, what mass of (i) mass of eutectic will be formed and (ii) mass of lead will separate out?	2
4	Define phase and component with examples.	2
5	Give the number of phases in the following system. (a) Mixture of oxygen and nitrogen. (b)Ice and water system. (c) Emulsion of oil and water or (d)Ethyl alcohol and water	2
6	What do you understand by degree of freedom? Explain with example.	2

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Syllabus and Question Bank for End Semester Examination

Physics and Nanotechnology (SEM II) 2021-22

Module 1 : Diffraction (Question Bank)

1. Differentiate between Fresnel and Farunhoffer diffraction. (3)
2. Discuss Fraunhoffer diffraction at single slit. Obtain the relation for resultant amplitude of wave disturbance arriving at any point P on the screen. (5)
3. In Fraunhoffer diffraction at single slit, resultant amplitude of wave disturbance arriving at any point P on screen is $E_\theta = E_m \frac{\sin\alpha}{\alpha}$ where $\alpha = \frac{\pi}{\lambda} a \sin\theta$ (Symbols have their usual meaning). Obtain conditions for principal maxima, minima and secondary maxima. (5)
4. Write condition of maxima and minima in single slit diffraction. (3)
5. Obtain the relation for width of central maximum obtained in single slit diffraction experiment. (5)
6. What is grating? What is grating element? Derive condition for maximum in diffraction grating experiment. (7)
7. Obtain condition for principal maximum in Fraunhoffer diffraction at N parallel slits. (5)
8. Explain how number of lines on grating decides the maximum number of orders od diffraction? (3)
9. Derive condition for absent spectra in plane diffraction grating. Explain with example. (3)
10. Explain the experimental method to determine the wavelength of spectral line using diffraction grating. (5)
11. What is Rayleigh criterion of just resolution? Define resolving power of grating. (3)
12. Obtain relation for resolving power of grating. (5)
13. Show that resolving power of diffraction grating is directly proportional to the order of the maximum. (5)
14. How do you increase resolving power of grating? (3)
15. What is the advantage of increasing the number of lines in the grating? (3)

Module 1 : Diffraction (Problems)

1. Calculate the angular position of the first minimum in Fraunhoffer diffraction at slit of width 10^{-6} m wide if it is illuminated by light of wavelength 4000 A^0.
2. A single slit of width 0.14 mm is illuminated with a monochromatic light. Diffraction pattern is observed on a screen kept at 2 meters from the slit. If the centre of the second dark band is 1.6 cm away from the middle of the central bright band, determine the wavelength of light.

3. For a grating having 15000 lines/inch, how many orders of primary maxima are possible to see, when Na-light is used as an incident ray? (For Sodium λ = 5893 A^0)

4. Sodium light of wavelength 5890 A^0 falls normally on a plane diffraction grating having 6000 lines per centimeter. How many diffraction orders will be observed?

5. What is the highest order spectrum that can be seen with monochromatic light of wavelength 6000 x 10^{-10} m by means of diffraction grating having 5000 lines/cm? Also calculate Grating Element of the grating.

6. Red light of wavelength 7500 A^0 is normally incident on a plane diffraction grating having 6000 lines per cm. How many diffraction orders are observed? If source is replaced by yellow one of wavelength 5890 A^0 and then by a violet one of wavelength 4300 A^0. How many orders would be observed in each case?

7. What is the maximum number of orders of diffraction observed for wavelengths of (i) 7200 A^0, (ii) 5000 A^0 (iii) 4200 A^0 for a diffraction grating having 6000 lines/cm.

8. Monochromatic light of wavelength λ = 6560 A^0 falls normally on a grating of 2 cm wide. The first order spectrum is produced at an angle of 19^0 from the normal. What is the total number of lines on the grating?

9. A diffraction grating used at normal incidence, gives a line 6000 A^0 in a certain order, which is superimposed on the other line 4500 A^0 of the next order. If the angle of diffraction is 33^0, how many lines/cm are there in the grating?

10. A diffraction grating used at normal incidence, gives a line 5400 A^0 in a certain order, which is superimposed on the other line 4050 A^0 of the next order. If the angle of diffraction is 30^0, how many lines/cm are there in the grating?

11. Which particular spectra would be absent when the width of opacity is double than that of transparency in grating?

12. A grating has 15 cm of the surface ruled with 6000 lines per cm. What is the resolving power of the grating in the first order?

13. Calculate minimum number of lines required on the grating so that it will just resolve the sodium lines in the first order spectrum. The wavelengths are 5890A^0 and 5896A^0.

14. A grating of 2 inches is ruled with 15000 lines per inch. Find the smallest wavelength separation that can be resolved in second order at a mean wavelength of 5000 A^0.

Module 2 : LASER and Optical Fibres (Question Bank)

1. What does LASER stand for? In what respect it differ from an ordinary source of light? (3)
2. How LASERs are different compared to X-rays? (3)
3. Differentiate between spontaneous emission and stimulated emission of radiation. (3)
4. What is polulation inversion? Explain its significance in the operation of LASER. (3)
5. What is pumping in laser? Mention the types of pumping methods. (3)
6. Differentiate between stimulated emission and spontaneous emission. (3)

7. What is the role of resonant cavity in the operation of laser? (3)
8. What is the role of He in He-Ne laser? (3)
9. Define – absorption, spontaneous emission, stimulated emission, metastable state, population inversion (5)
10. With a neat energy level diagram, describe the construction and working of He-Ne laser. What are its advantages? (8)
11. With a neat sketch explain construction and working of Nd-YAG laser. (5)
12. Explain construction and working of semiconductor laser. (5)
13. Derive Einstein relations and explain their significance. (5)
14. What is holography? Explain the construction of hologram and reconstruction of image from hologram. (5)
15. What is the difference between holography and photography? (3)
16. Describe applications of LASER. (5)
17. Define the following terms – Critical angle of incidence, Acceptance angle. (3)
18. Define the following terms- Numerical Aperture and Total Internal Reflection. (3)
19. Mention the conditions for Total Internal Reflection. (3)
20. Differentiate between step index fibre and graded index fibre. (3)
21. What is the advantage of graded index optical fibre over the step index optical fibre? (3)
22. Why would you recommend the use of optical fibre in communication system? (3)
23. Distinguish between single mode and multimode fibres. (3)
24. Derive the expression for numerical aperture for a step index optical fibre. (5)
25. Explain fibre optic communication system with a diagram. What are advantages of using optical fibre? (5)
26. Describe types of optical fibres. (5)
27. Why would you recommend optical fibre in communication network? (3)
28. Explain construction and working of a photodiode.
29. How optical fibre can be used in temperature sensing application?
30. How optical fibre can be used in smoke sensing application?
31. How optical fibre can be used as a water level indicator?

Module 2 : LASER and Optical Fibres (Problems)

1. Calculate the numerical aperture of a fibre with core index $n_1 = 1.61$ and cladding index $n_2 = 1.55$.
2. Calculate the numerical aperture of a fibre with core index $n_1 = 1.65$ and cladding index $n_2 = 1.53$.
3. The numerical aperture of an optical fibre is 0.5 and core refractive index is 1.54. Find refractive index of cladding. (JUN-04)
4. Numerical aperture of a fibre is 0.5 and core refractive index is 1.48. Find cladding refractive index and acceptance angle.
5. Calculate the acceptance angle for an optical fibre whose core refractive index is 1.48 and cladding refractive index is 1.39. (DEC-96)
6. A step index fibre is made with a core of index 1.52 and diameter 29 ⌈m and cladding refractive index 1.5189. If it is operated at wavelength 1.3 ⌈m, find V number of fibre and no. of mode it will support.
7. Find the core radius necessary for single mode operation at 850 nm in step index fibre with $n_1 = 1.480$ and $n_2 = 1.47$. What is the numerical aperture and maximum acceptance angle of this fibre.
8. An optical fibre has core diameter of 6 micrometer and core refractive index is 1.45. The

critical angle is 87^0. Calculate i) refractive index of cladding, ii) acceptance angle and iii)number of modes propagating through fibre when wavelength of light is 1 micrometer

Module 3 : Electrodynamics

1. Let $\vec{C} = \vec{A} - \vec{B}$. Calculate dot product of $\vec{C}$ with itself. (3)
2. Write the separation vector $\vec{r}$ from the source point (2,8,7) to the field point (4,8,6). Determine its magnitude. (3)
3. Two vectors are represented by - $\vec{A} = 2\,\hat{x} + 2\,\hat{y}$ and $\vec{B} = 3\,\hat{x} + 4\,\hat{y} - 2\,\hat{z}$. Find $\vec{A} \times \vec{B}$ and show that $\vec{A} \times \vec{B}$ is at right angles to $\vec{A}$. (3)
4. Two vectors are given by - $\vec{A} = 3\,\hat{x} + 4\,\hat{y} + \hat{z}$ and $\vec{B} = 2\,\hat{y} - 5\,\hat{z}$. Find the angle between $\vec{A}$and $\vec{B}$ using dot product. (3)
5. What is gradient of a scalar field? What is its significance? (3)
6. Find the gradient of V = $x^2 + y^2 + z$ (3)
7. Find the gradient of $r = \sqrt{x^2 + y^2 + z^2}$. (3)
8. What is divergence of a vector field? Express it in the Cartesian co-ordinate system. (3)
9. What is divergence of a vector field? Give its significance. (3)
10. Find divergence of a position vector. (3)
11. If $\vec{A} = x^2 z\hat{x} - 2y^2 z^2 \hat{y} + xy^2 \hat{z}$, find $\vec{\nabla}.\vec{A}$ at point (1,-1,1). (3)
12. Determine the divergence of vector field $\vec{F} = x^2 y\,\hat{x} + (x^3 - x)\,\hat{y} + 4y^2\,\hat{k}$. (3)
13. How to find curl of a vector field? (3)
14. Calculate curl of $\vec{v} = -y\hat{x} + x\hat{y}$. (3)
15. What is the significance of curl of a vector field? (3)
16. Determine the curl of vector field $\vec{B} = yz\,\hat{x} + 4xy\,\hat{y} + y\,\hat{k}$. (3)
17. Explain the statement – “Magnetic monopoles does not exist” using Maxwell’s equation. (3)
18. Find the angle between the face diagonals of a cube. (5)
19. Show that divergence of a curl is zero. (5)
20. State Gauss law for electric field. Derive first Maxwell’s equation. (5)
21. State Gauss law for Magnetic field. Derive second Maxwell’s equation. (5)
22. State Faraday’s law. Obtain third Maxwell’s equation for static field and varying field. (5)
23. State Ampere’s circuital law. Obtain fourth Maxwell’s equation for static field and time varying field. (5)
24. Write Maxwell’s equations in integral form and differential form. (5)
25. Write Maxwell’s equations in differential form and mention their physical significance. (5)

Module 4 : NANOTECHNOLOGY I: Basics and Types of Nanomaterials

1. What are nano materials? What is significance of surface area to volume ratio in nano materials. (3)
2. What is the reason behind change in optical properties at nano scale? Give two example mentioning how optical properties are affected when the material is reduced to nanoscale. (4)
3. What do you mean by quantum dot and photonic crystal? (3)
4. Which effects lead to altered conductivity in nanomaterials? Mention any two examples showing change in electrical properties in nanomaterials. (4)
5. How magnetic nanomaterials can be used in targeted drug delivery? (3)

6. Why the mechanical properties of material change at nano scale? Give one example. (3)
7. Classify nanomaterials based on dimensions. (5)
8. What are morphological characteristics of nanoparticles? Why morphology is important? (3)
9. What is the reason behind change in chemical properties at the nano scale? (3)
10. Describe any five applications of nanotechnology in brief. (5)

Course: C Programming (SEM II)

Question Bank for ESE Even Sem 2021-22

Module 1

1. What is Computer. Describe the various types of computers.
2. What are input devices? Mention and explain any two input devices,
3. With a neat diagram explain the basic structure of a computer.
4. What is Pseudocode? Explain with example, how it is used as a problem solving tool.
5. Write a Pseudocode to find the sum and average of given three numbers.
6. Define Algorithm. Write an algorithm to find the area and perimeter of a circle.
7. Write an algorithm to find the smallest of three numbers.
8. Compare Pseudocode with an algorithm.
9. Define Flowchart. Explain with an Example.
10. Write a C program to compute simple interest.
11. Explain the basic structure of a C program with an example.
12. Write the general structure of C program. Explain with an example.
13. Write and explain the basic concepts of a C program.
14. What is an **identifier**(variable)? What are the rules to construct identifier(variable)?
15. Classify the following as valid/invalid Identifiers.
    i)Num2 ii) $num1 iii) +add iv) a_2 v)199_space vi) _apple vii) #12
16. What is **Variable?** List the restrictions on the variable names.
17. Explain the rules for constructing variables in C language.
18. Define i) Constant ii) Associativity iii) Precedence.
19. Explain with example, the various constants available in ‘C’ language.
20. Explain any five operators used in C language.
21. What is an operator? List and explain various types of operators.

22. Explain the following operators in C language
    i) Relational ii) Logical iii) Ternary
23. What is an assignment statement? Give the general form of an assignment statement.
24. What are basic data types available in 'C"? Write the significance of each data type.
25. What are the formatted input and output functions**.** Explain with examples.
26. Write the guidelines to use scanf () and printf () functions in C language.
27. What is the purpose of scanf () and printf () statement?
28. Write a C program in C to find the area and perimeter of circle.
29. Write a program in C to print the numbers from 4 to 9 and their squares.
30. Write a C program which takes as input p,t,r. Compute the simple interest and display the result.
31. Write a C program to find the area of triangle when we know the length of all three of its sides.
32. Write a C program to find the largest of three numbers using ternary operator.
33. what is an expression? Evaluate the following expressions
    i) 100 % 20 <=20-5+100 % 10-20==5>=1 !=20
    ii) a + =b*=C-=5 where a=3 b=5 and c=8
34. Convert the following mathematical expression into C equivalent
    i. area= s(s-a)(s-b)(s-c)
    ii. $x = -b + b^2 – 4ac$

Module 2

1. What is decision making and Looping statements. Explain their types.
2. Explain different conditional (branching) statements.
3. Difference between While and Do While Loop.
4. Explain break and continue statements.
5. Write a program to evaluate the sum of first n natural numbers by using while loop.

6. Print even number of from 1 to n. Using while loop.
7. print odd number of from 1 to n. Using while loop.
8. Print sum of even numbers from 1 to n. Using do while loop.
9. Give one example depicting use of conditional operator.
10. What is switch case and write the syntax of switch with example.
11. Write a program to print the middle of three numbers using if – else if ladder.
12. Differentiate between library function and user defined function.
13. Differentiate between nested if and else if ladder statement. Explain with example.
14. Write a program to generate pattern.

1

121

12321

1231321

15. Write a C program to find factorial of a number using do-while, when number is entered by user.
16. Write a program to find the area and perimeter of a rectangle.
17. Write a program which takes as input p, t, r. Compute simple interest and display the result.
18. What is two-way selection statement? Explain if else, cascaded if – else with examples.
19. Write a C program that takes operator '+', '– ', '* ', '/ ', and two operands. Perform using switch statement.
20. Write a C program to find reverse of an integer number NUM and check whether it is palindrome or not.
21. Write a program to print naming words of the numbers from 0 to 9 using switch case.
22. Write a program to display the table of a number using for loop.

Module III

1. What is function?
2. Explain the difference between user defined and library functions.
3. Explain functions call, function definition and function prototype and write a function to find the sum of two numbers.
4. Differentiate between call by value and call by reference with examples.
5. Explain the classification of user defined functions with examples.
6. Explain the type of functions based on parameters with examples.
7. Write a C program using function to check whether the given number is prime or not.
8. Write a program in 'C' using functions to swap two numbers.
9. What are actual parameters and formal parameters? Illustrate with example.
10. Write a C program to find the factorial of a number using functions.
11. Give the scope and lifetime of the following
12. i)External variable ii) Static variable iii) Automatic variable iv) Register variable.
13. What is Recursion? Explain with example.
14. Write a C program to compute polynomial co-efficient n_{cr} using recursion.
15. Explain the recursion. And write a program to find n^{th} term of Fibonacci series.
16. Write a C program using recursive function for Binary to Decimal Conversion.
17. WAP for calculate factorial of given number using recursion.
18. Write a program using function to find sum of digits of a given number.
19. WAP to find the greatest common divisor using recursion.
20. WAP to check entered year is leap year or not using function.

Module IV

1. What is array? Explain the declaration and initialization of one dimensional and two-dimensional arrays with an example.
2. Write a C program to read N integers into an array A and to find the i) sum of odd numbers ii) sum of even numbers with appropriate headings.
3. Write an algorithm and develop a C program that reads N integer numbers from array and arrange them in ascending order.
4. Write a C program to find the transpose of a given matrix.
5. Write a C program to find that accepts 3*3 ordered matrices A and B, and compute the following (i)Addition ii) Subtraction iii) Multiplication.
6. Write a C program to find the sum and average of n integer numbers.
7. Define String? How string is declared and initialized? Explain string input/output functions with an example.
8. Define a string. Explain any 4 string library functions with syntax and example.
9. Write a C program to implement string copy operations STRCOPY (str1, str2) that copies string strl to another str2 without using library function.
10. Write a C program to replace each constant in a string with the letter ‘u’ with ‘U’ and ‘r’ with ‘R’ in the string “COMPUTER”.
11. Write a C program to concatenate two strings without using built-in function strcat().
12. Write a C program to check whether the given string is palindrome or not without using in built function.
13. What is the difference between character array and string.
14. Write a program that will capitalize all the letter of string.
15. WAP for display sum of diagonal elements of matrix.
16. WAP for Display transpose of matrix.
17. WAP that reads a line of text and counts all occurrence of a particular word.
18. WAP to compare strings without using string function.

19.WAP to convert Decimal number to Hexadecimal Number.

20. WAP for search entered element is present in array or not.

MODULE V

1. What is Structure? Explain the C syntax of structure declaration with example.

2. Differentiate between structures and unions.

3. Write a C program to maintain a record of 'n' students details using an array of structures with four fields (rolls no, name, marks, grade). Assume appropriate data type for each field. Print the marks of the student given the student's name as input.

4. Explain the difference between array and structures.

5. Explain with example how to create a structure using 'typedef".

6. Write a program to illustrate the use of array of structures.

7. How structure is different from array.

8. What is different between a structure tag and a structure instance.

9. Define structure to store the following information of an employee (Employee Code, Name, Salary, Department Number). Enter one record and Display.

10.Write a program using structure for display Cricketer Information like name, Total no. of matches, Total Run, Total wicket etc.

11.What will be output of program

```
Struct {
        int i;
        float f;
        };
int main()
{
        int i=5;
        float f=9.75;
        printf("%d %f", i, f);
        return(0);
```

}

12. Define structure type named Data that can hold a single string of up to 20 characters, write a program for the same.
13. Define nested structure. Explain with Syntax.
14. How to pass structure in to function?
15. How to access structure. Explain with example.
16. Define and explain array of structure.

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Question Bank for ESE for the subject EM-II AY 2021-22

Topic :	***Module 1: Differential equations of First order and First degree***
1	Solve $\frac{dy}{dx} = \frac{tany-2xy-y}{x^2-xtan^2y+\sec^2 y}$
2	Solve $(1+y^2)dx = \left(\sqrt{1+y^2}\sin y - xy\right)dy$
3	Solve $ydx - xdy + \log x\, dx = 0$
4	Solve $y(2xy+1)dx + x(1+2xy-x^3y^3)dy = 0$
5	Solve $xe^x(dx-dy) + e^x dx + ye^y dy = 0$
6	Solve $\frac{dy}{dx} - xy = y^2 e^{-\frac{x^2}{2}} \log x$
7	Solve $(\mathrm{x}^4 + \mathrm{y}^4)\mathrm{dx} - \mathrm{xy}^3\mathrm{dy} = 0$
8	Solve $(\mathrm{y}\log\mathrm{y})\mathrm{dx} + (\mathrm{x} - \log\mathrm{y})\mathrm{dy} = 0$
9	Solve $\frac{\mathrm{dy}}{\mathrm{dx}} = e^{x-y}(e^x - e^y)$
10	Solve $(1+y^2)dx = (e^{\tan^{-1}y} - x)dy$
11	Solve $\frac{dy}{dx} - \frac{\tan y}{1+x} = (1+x)e^x \sec y$
12	Solve $(1+\sin y)\frac{dy}{dx} = [2y\cos y - x(\sec y + \tan y)]$
13	Solve $\frac{dz}{dx} + \frac{z}{x}\log z = \frac{z}{x^2}(\log z)^2$
14	Solve $\frac{dy}{dx} + x(x+y) = x^3(x+y)^3 - 1$
15	Solve $(xy\sin xy + \cos xy)ydx + (xy\sin xy - \cos xy)xdy = 0$
16	Solve $y(x+y)dx - x(y-x)dy = 0$
17	Solve $y(xy + e^x)dx - e^x dy = 0$
18	Solve $(e^y + 1)\cos x\, dx + e^y \sin x\, dy = 0$
19	Solve $x\sin x\, dy + (xy\cos x - y\sin x - 2)dx = 0$
20	Solve $(y - xy^2)dx - (x + x^2 y)dy = 0$
Topic :	***Module 2: Linear differential equations with constant coefficients and variable coefficients of higher order***
1	Solve $(D^3 - 5D^2 + 8D - 4)y = 0$
2	Solve $(D^4 + 6D^2 + 9)y = 0$

3	Solve $(D^3 + 3D)y = \cosh 2x \sinh 3x$
4	Solve $(D^3 - 2D + 4)y = 3x^2 - 5x + 2$
5	Solve $(D^3 + D)y = \cos t + t^2 + 3$
6	Solve $(D - 1)^2(D^2 + 1)y = 3x^2 - 5x + 2$
7	Solve $(D^2 - 8D + 16)y = \frac{e^{4x}}{x^2}$
8	Solve $(D^2 - 4D + 4)y = e^{2x} + x^3 + \cos 2x$
9	Solve $(D^2 + 4D + 4)y = xe^{-x} \sinh x$
10	Solve $(\mathrm{D}^2 + 2\mathrm{D} + 1)\mathrm{y} = \mathrm{x}e^{-\mathrm{x}} \cos \mathrm{x}$
11	Solve $(\mathrm{D}^2 - 4\mathrm{D} + 4)\mathrm{y} = \mathrm{e}^{2\mathrm{x}} \sec^2 \mathrm{x}$
12	Solve $(\mathrm{D}^2 - 1)\mathrm{y} = \mathrm{x} \sin 3x + \cos x$
13	Solve $(\mathrm{D}^4 + 2\mathrm{D}^2 + 1)\mathrm{y} = \mathrm{x}^2 \cos x$
14	Solve $(D^2 - 1)y = x^2 \cos 2x$
15	Solve by method of variation of parameters, $\frac{d^2y}{dx^2} + y = \sec x \tan x$
16	Solve by method of variation of parameters, $(D^2 - 6D + 9)y = \frac{e^{3x}}{x^2}$
17	Solve by method of variation of parameters, $(D^2 - 4D + 4)y = e^{2x} \sec^2 x$
18	Solve by method of variation of parameters, $(D^2 - 1)y = \frac{2}{1+e^x}$
19	Solve by method of variation of parameters, $(D^2 + 2D + 1)y = e^{-x} \log x$
20	Solve by method of variation of parameters $(D^2 + 3D + 2)y = \frac{1}{1+e^x}$
Topic :	***Module 3: Beta Gamma Functions***
1	Evaluate $\int_0^\infty x^{1/4} e^{-\sqrt{x}} dx$
2	Show that $\int_0^\infty x e^{-x^8} dx \int_0^\infty x^2 e^{-x^4} dx = \frac{\pi}{16\sqrt{2}}$
3	Evaluate $\int_0^1 (x \log x)^4 dx$
4	Evaluate $\int_0^\infty 7^{-4x^2} dx$
5	Show that $\int_0^{2a} x^2 \sqrt{2ax - x^2}\, dx = \frac{5}{8} a^4 \pi$
6	Prove that $\int_0^1 \sqrt{1 - \sqrt{x}}\, dx \int_0^{1/2} \sqrt{2y - 4y^2}\, dy = \frac{\pi}{30}$
7	Evaluate $\int_0^1 \frac{dx}{\sqrt{1-x^4}}$
8	Evaluate $\int_0^1 x^5 \sin^{-1} x\, dx$

9	Evaluate $\int_0^\infty \frac{x^2}{(1+x^6)^{7/2}}\, dx$
10	Evaluate $\int_0^{\pi/4}(1+\cos 4\theta)^5\, d\theta$
11	Evaluate $\int_0^\infty x^2 7^{-4x^2} dx$
12	Evaluate $\int_0^1 x^3 \left(\log\frac{1}{x}\right)^4 dx$
13	Evaluate $\int_0^1 x^5 \sqrt{\frac{1+x^2}{1-x^2}}\, dx$
14	Evaluate $\int_0^1 \sqrt{\sqrt{x}-x}\ dx$
15	Evaluate $\int_0^\pi \sin^2\theta\,(1+\cos\theta)^3\, d\theta$
16	Evaluate $\int_0^\infty \left(\frac{x}{1+x^2}\right)^3\ dx$
17	Evaluate $\int_{-\pi/2}^{\pi/2} \sin^4 x \cos^2 x\ dx$
18	Evaluate $\int_0^{\pi/4} \cos^3 2\theta \sin^2 4\theta\ d\theta$
19	Prove that $\int_3^7 \sqrt[4]{(x-3)(7-x)}dx = \frac{2\left(\gamma\left(\frac{1}{4}\right)\right)^2}{3\sqrt{\pi}}$
20	Prove that $\beta(x,x) = \frac{1}{2^{2x-1}}\beta\left(x,\frac{1}{2}\right)$
Topic :	***Module 4: Multiple Integrals – I***
1	Evaluate $\int_0^1 \int_{x^2}^x xy(x^2+y^2)dydx$
2	Evaluate $\int_0^1 \int_0^{\sqrt{1+x^2}} \frac{1}{1+x^2+y^2}\, dxdy$
3	Evaluate $\int_0^{\pi/4} \int_0^{\sqrt{\cos 2\theta}} \frac{r}{(1+r^2)^2} drd\theta$
4	Change the order of integration and evaluate $\int_0^2 \int_{2-\sqrt{4-y^2}}^{2+\sqrt{4-y^2}} dx\, dy$
5	Change the order of integration and evaluate $\int_0^a \int_0^{a-\sqrt{a^2-y^2}} \frac{xy\log(x+a)}{(x-a)^2} dx\, dy$
6	Change the order of integration and evaluate $\int_0^a \int_{x^2/a}^{2a-x} xy\, dx\, dy$
7	Change the order of integration by expressing it as a single integral and evaluate $\int_0^1 \int_0^y (x^2+y^2)\, dx\, dy + \int_1^2 \int_0^{2-y} (x^2+y^2)\, dx\, dy$
8	Change the order of integration and evaluate $\int_0^1 \int_x^{\sqrt{2-x^2}} \frac{x}{\sqrt{x^2+y^2}} dx\, dy$
9	Evaluate $\iint \sin\theta\, dA$ over R, where R is the region in the first quadrant that is outside the circle $r=2$ and inside the cardioid $r=2(1+\cos\theta)$
10	Evaluate $\iint \frac{r}{\sqrt{r^2+4}}\, drd\theta$ over one loop of $r^2 = 4\cos 2\theta$.
11	Evaluate $\iint xy\, dxdy$ over the region R given by $x^2+y^2-2x=0$, $y^2=2x$ and $y=x$
12	Evaluate $\iint x(x-y)\, dxdy$ over the region R which is triangle whose vertices are

	$(0,0),(1,2),(0,4)$
13	Evaluate $\iint x^2\,dxdy$ over the region R in the first quadrant bounded by $xy=16, y=x, y=0$ and $x=8$.
14	Change the order of integration and evaluate $\int_0^2 \int_{\sqrt{2x}}^2 \frac{y^2}{\sqrt{y^4-4x^2}}\,dx\,dy$
15	Change the order of integration and evaluate $\int_0^2 \int_0^{4-x^2} \frac{xe^{2y}}{4-y}\,dx\,dy$
16	Change the order of integration and evaluate $\int_0^3 \int_{y^2/9}^{\sqrt{10-y^2}}\,dx\,dy$
17	Evaluate $\iint r^3 dr\,d\theta$ over the area bounded between the circles $r=2\sin\theta$ and $r=4\sin\theta$
18	Evaluate $\iint \frac{y}{(a-x)\sqrt{ax-y^2}}\,dxdy$ over the region R bounded by $y^2=ax$ and $y=x$.
19	Evaluate $\int_0^{a\sqrt{3}} \int_0^{\sqrt{x^2+a^2}} \frac{x}{y^2+x^2+a^2}\,dydx$
20	Evaluate $\int_{-\pi/4}^{\pi/4} \int_0^{\sqrt{\cos 2\theta}} \frac{r}{(1+r^2)^2}\,drd\theta$
Topic :	***Module 6: Numerical Methods***
1	Using Euler's method find the approximate value of y when $\frac{dy}{dx}=x^2+y^2$ and $y(0)=1$, at $x=1$ in five steps.
2	Using Euler's method find the approximate value of y when $\frac{dy}{dx}=\frac{y-x}{\sqrt{xy}}$ and $y(1)=2$, at $x=1.5$ in five steps taking $h=0.1$.
3	Using Euler's method find the approximate value of y when $\frac{dy}{dx}=y^2-\frac{y}{x}$ and $y(1)=1$, at $x=1.6$ taking $h=0.1$.
4	Using Euler's modified method find the approximate value of y when $\frac{dy}{dx}=\log(x+y)$ and $y(1)=2$, at $x=1.2$ taking $h=0.2$.
5	Using Runge-Kutta method of 2nd order find the value of y satisfying the equation $\frac{dy}{dx}=\log(x+y)$, $y(1)=2$, for $x=1.2$ at $h=0.2$.
6	Using Euler's Modified method find the value of y satisfying the equation $\frac{dy}{dx}=2+\sqrt{xy}$, $y(1.2)=1.6403$, for $x=1.6$ correct up to 4 decimal places by taking $h=0.2$.
7	Using Euler's Modified method find the value of y satisfying the equation $\frac{dy}{dx}=x+3y$, $y(0)=1$, for $x=0.2$ correct up to 4 decimal places by taking $h=0.1$.
8	Using Runge - Kutta method of 4th order find the value of y satisfying the equation $\frac{dy}{dx}=\frac{(y^2-x^2)}{(y^2+x^2)}$, $y(0)=1$, for $x=0.2$ and $x=0.4$
9	Using Runge - Kutta method of 4th order find the value of y satisfying the equation $\frac{dy}{dx}=\frac{1}{x+y}$, $y(0)=1$, for $x=0.5$ at $h=0.5$.
10	Using Runge - Kutta method of 4th order find the value of y satisfying the equation $\frac{dy}{dx}=\frac{(y^2-x^2)}{(y^2+x^2)}$, $y(0)=1$, for $x=0.4$ taking $h=0.2$.
11	Using Runge-Kutta method of 2nd order find the value of y satisfying the equation $\frac{dy}{dx}=x-y^2$, $y(0)=1$, for $x=0.1$ correct upto 4 places by taking $h=0.05$.

<table>
<tr><td>12</td><td>Given the following values of e^x, evaluate $\int_0^{2.5} e^x\,dx$, using Trapezoidal rule.
<table>
<tr><td>X</td><td>0</td><td>0.5</td><td>1</td><td>1.5</td><td>2</td><td>2.5</td></tr>
<tr><td>$y = e^x$</td><td>1</td><td>1.65</td><td>2.72</td><td>4.48</td><td>7.39</td><td>12.18</td></tr>
</table></td></tr>
<tr><td>13</td><td>A rocket is launched from the ground. Its acceleration is registered during the first 80 seconds and is given in the following table.
<table>
<tr><td>t</td><td>0</td><td>10</td><td>20</td><td>30</td><td>40</td><td>50</td><td>60</td><td>70</td><td>80</td></tr>
<tr><td>$a\left(\frac{m}{s^2}\right)$</td><td>30</td><td>31.63</td><td>33.34</td><td>35.47</td><td>37.75</td><td>40.33</td><td>43.25</td><td>46.69</td><td>50.67</td></tr>
</table></td></tr>
<tr><td>14</td><td>Find the value of $\int_0^1 \frac{x^2}{1+x^3}dx$ by dividing the interval in 6 equal parts using i) Trapezoidal Rule ii) Simpson's 1/3rd Rule and compare with exact value.</td></tr>
<tr><td>15</td><td>Find the value of $\int_0^1 \frac{1}{1+x^2}dx$ by dividing the interval in 6 equal parts using i) Trapezoidal Rule ii) Simpson's 1/3rd Rule.</td></tr>
<tr><td>16</td><td>Find the value of $\int_4^{4.2} \log x\,dx$ by dividing the interval in 6 equal parts using Simpson's 1/3rd Rule.</td></tr>
<tr><td>17</td><td>Compute the value of $\int_0^{\pi/2} \frac{(\sin x)}{x}dx$ by using Simpson's 3/8th Rule by dividing the interval in to 6 equal parts.</td></tr>
<tr><td>18</td><td>Using Simpson's 3/8th rule find $\int_0^{0.3} \sqrt{1-8x^3}\;dx$ by dividing the interval in 3 equal parts.</td></tr>
<tr><td>19</td><td>Evaluate $\int_0^{\pi/2} \sqrt{\sin x + \cos x}\,dx$ by using Simpson's 3/8th Rule by dividing the interval in to 6 equal parts.</td></tr>
<tr><td>20</td><td>Evaluate $\int_{0.2}^{1.4} (\sin x - \log x + e^x)dx$ by using Simpson's 3/8th Rule by dividing the interval in to 6 equal parts.</td></tr>
</table>