2024

COMPUTER SCIENCE — GENERAL

Paper : DSE-B-1, DSE-B-2 and DSE-B-3

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

DSE-B-1

(Embedded Systems)

Full Marks : 50

Answer *question no.* **1** and *any four* questions from the rest.

1. Answer *any five* questions :　　　　　　　　　　　　　　　　　　　2×5

   (a) Explain the function of the IE (Interrupt Enable) register in MCS-51.

   (b) Name at least two Special Function Registers (SFR).

   (c) State the significance of PORT registers.

   (d) What are the different flags related to MCS-51?

   (e) What is the function of the stack pointer (SP) in MCS-51 and how is it used?

   (f) How does the MUL AB instruction function in MCS-51?

   (g) How can external interrupts be triggered in the MCS-51 microcontroller?

   (h) What is the significance of the XCH instruction in MCS-51?

2. (a) Differentiate between Program and Data memory of MCS-51.

   (b) What are the main applications of microcontroller?　　　　　　　　　7+3

3. (a) What is the use of VHDL?

   (b) How does the use of subroutines improve code organization in MCS-51 programming?　　5+5

4. (a) What are the different types of bit-oriented program jumps in MCS-51? Explain in brief with suitable example and diagram.

   (b) How does the ACALL instruction differ from LCALL in MCS-51?　　　　5+5

5. (a) Draw the internal architecture of 8051 microcontroller and briefly explain each block.

   (b) What is the function of the PSW register?　　　　　　　　　　　　　8+2

Please Turn Over

6. (a) What is the purpose of the MOVX instruction in MCS-51?

   (b) What does the ORL and ANL instruction do in the MCS-51 microcontroller?

   6+4

7. (a) Explain stack operation in MCS-51 with proper illustrations.

   (b) Write the functions of IE and SBUF.

   5+5

8. (a) Highlight the main differences between Microcontroller and Microprocessor.

   (b) Differentiate between bit addressable and byte addressable memory in MCS-51.

   5+5

DSE-B-2

(Object Oriented Programming)

Full Marks : 50

Answer *question no.* **1** and *any four* questions from the rest.

1. Answer *any five* questions : 2×5

   (a) Explain the term data abstraction with an example.

   (b) State differences between class and object.

   (c) What do you mean by implicit data type conversion?

   (d) What are the restrictions of static method?

   (e) What is the significance of 'this' operator?

   (f) Discuss the use of wrapper class.

   (g) Name any four in-built standard java packages.

   (h) How can textbox and button be created using AWT?

2. What is overloading? Explain constructor overloading with an example. Differentiate between overloading and overriding. 2+4+4

3. (a) What is inner class? Differentiate it with nested class with an example.

   (b) How can function overriding be restricted?

   (c) How can inheritance be restricted? (2+4)+2+2

4. (a) Define package. Which package is imported by default in Java? How can packages be imported in Java?

   (b) What is the difference between equals() and "= ="?

   (c) Write a program in Java that inputs a string and print only the odd positioned characters in upper case.

   Eg. string : Who are you?

   output : W O R Y U (1+1+2)+2+4

5. (a) How does Java handle exception?

   (b) Show the uses of throws and give an example.

   (c) How to create and handle own exception? 3+(2+2)+3

Please Turn Over

6. (a) What do you mean by default constructor? What is the use of class? Give an example.

   (b) What is the use of interface in Java? State the difference between abstract class and interface in Java.

   (2+4)+(2+2)

7. (a) Explain the following functions with example :

   (i) valueOf()

   (ii) setLength()

   (iii) drawRect()

   (iv) isAlive().

   (b) Name four methods which performs operations on strings in a Java String class. (2+2+2+2)+2

8. Write short notes on (*any two*) :

   (a) Java database connectivity   5×2

   (b) Java package

   (c) Garbage Collection in Java

   (d) Java IO.

DSE-B-3

(Computational Mathematics)

Full Marks : 50

Answer *question no.* 1 and *any four* questions from the rest.

2×5

1. Answer *any five* questions :

   (a) Define Hamiltonian circuit of a graph.

   (b) What is a simple graph?

   (c) What is a connected graph?

   (d) Discuss the limitations of the Simpson's $1/3$ rd rule for solving definite integrals.

   (e) What is the condition of convergence of the Gauss-Seidel method for solving a set of linear equations?

   (f) What is the rank of a coefficient matrix in a system of linear equations?

   (g) Is there any limitations of the Newton-Raphson's method? Explain your answer.

   (h) If $f(x) = 4 \cos x - 6x$, find the relative percentage error in $f(x)$ for $x = 0$, if error in $x = 0.005$.

2. (a) What is Euler graph? Show that if G is an Euler connected graph then every vertex of G are of even degree.

   (b) What is a tree? Show that a tree with n vertices has exactly $(n-1)$ edges.

   5+5

3. (a) Define planar graph. Give an example.

   (b) When are two graphs said to be isomorphic? Discuss with a suitable example.

   (c) Show that the number of vertices of odd degree in a graph is always even.

   2+3+5

4. (a) Solve the following system of linear equations by Gauss-Jordan Elimination method :

$$2x + 3y - 4z = 1$$
$$x - 2y + 3z = 2$$
$$-4x + y - 2z = 3$$

   Correct up to two decimal places.

   (b) Define absolute error, relative error and percentage error.

   7+3

5. (a) Using the Bisection method, compute the real root of $x^3 - 3x^2 + 2x - 2 = 0$ correct up to two decimal places.

   (b) Prove that $\Delta \cdot \nabla = \Delta - \nabla$, where $\Delta f(x) = f(x + h) - f(x)$ and $\nabla f(x) = f(x) - f(x - h)$.

   6+4

Please Turn Over

6. Write down the composite expression for Simpson's $1/3$ rd rule. Evaluate $\displaystyle\int_{1}^{2} \frac{dx}{\sqrt{1+x^2}}$, by taking 8 intervals using this rule. Compute the error in this case.

7. (a) Given the following table, find $f(2.6)$ using Newton's backward interpolation polynomial technique.

x	0	1	2	3	4	5
y	−7	−9	−11	−7	9	43

2+6+2

(b) Discuss the geometrical interpolation of Newton-Raphson method with a diagram.

8. (a) Solve $x - 2 \sin x - 3 = 0$ correct up to five significant figures by Newton-Raphson method.

6+4

(b) Solve the following system of linear equations by Gauss elimination method.

$$x - y + 2z = 4$$
$$-3x + 4y - z = 2$$
$$2x + 3y + 4z = 1$$

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5+5