Total No. of Questions—**5**] [Total No. of Printed Pages—**4**

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[5423]-1

F.Y. B.Sc. EXAMINATION, 2018
COMPUTER SCIENCE
Paper-I
(CS-101 : Problem Solving Using Computers and 'C' Programming)
(2013 PATTERN)

Time : Three Hours **Maximum Marks : 80**

N.B. **:—** (*i*) *All* questions are compulsory.
(*ii*) Figures to the right indicate full marks.

1. Attempt *all* of the following : [10×1=10]

(*a*) Is 'C' language high level language ? True/False.
(*b*) What is a pointer ?
(*c*) State the use of rewind() function.
(*d*) List the functions for <string.h> file.
(*e*) What is a recursive function ?
(*f*) What is a global variable and local variable ?
(*g*) What is the use of comment operator ?
(*h*) List the different data types.
(*i*) List the different Backslash character constants.
(*j*) Which function is used to calculate 'square root' of A in 'C' from math.h library ? Give syntax.

2. Answer the following (any *four*) : [4×5=20]

(*a*) Explain 'switch-case' statement with suitable example.
(*b*) Write notes on :
(*i*) structure
(*ii*) union.

P.T.O.

(*c*) What is function ? Explain its definition and declaration with suitable example.

(*d*) Explain array with its types. Give example.

(*e*) Explain the following function with example :

(*i*) isupper() (*ii*) islower()

(*iii*) isalpha() (*iv*) isdigit()

3. Answer the following (any *four*) : [4×5=20]

(*a*) Write an algorithm and draw a flowchart for 'swapping of two numbers'.

(*b*) Explain the following dynamic memory allocation functions with example :

(*i*) malloc() (*ii*) calloc()

(*iii*) realloc() (*iv*) free()

(*c*) What will be the output of the following code ? Justify.

(*i*)
```
#include<stdio.h>
void func(int x, int y, int z)
    {
        printf("%d %d %d", x, y, z);
    }
```

(*ii*)
```
void main()
    {
        int var=15;
        func(var, var++, ++var);
    }
```

(*d*) Write output for the following code :

```
#include<stdio.h>
int print(int a, int b)
    {
      printf("\n a=%d\n", a);
      printf("\n b=%d\n", b);
        return 0;
    }
```

```
main()
{
        int(*fptr) (int, int);
        fptr=print;
        print(2, 3);
        fptr(2, 3);
        return 0;
}
```

(*e*) Find and correct error in the following code :

```
#include(stdio.h)
int main()
    {
        char ch='c';
        const char *ptr=&ch;
        *ptr='a';
        return 0;
    }
```

4. Answer the following (any *four*) : [4×5=20]

(*a*) Write a program to display the following pattern (n lines) :

```
*
* * *
* * * * *
```

(*b*) Write a program to reverse all elements of a matrix.

(*c*) Write a program to copy the contents of one text file to another.

(*d*) Write a program to check the given number is positive or negative using function.

(*e*) Write a menu driven program using string library functions for :

(*i*) Copy of string

(*ii*) Concatenation of two strings.

5. Answer the following (any *two*) : [2×5=10]

(*a*) Write a note on 'command line arguments'.

(*b*) Explain :

(*i*) Simple macro substitution

(*ii*) Macros with argument

(*iii*) Nesting of macros.

(*c*) Explain the following :

(*i*) pointer to pointer

(*ii*) goto statement

(*iii*) Break statement.

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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S.Y. B.Sc. (First Semester) EXAMINATION, 2018

COMPUTER SCIENCE

Paper I

(CS-211 : Data Structures Using 'C')

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) Assume suitable data if necessary.

1. Attempt all of the following : [10×1=10]

(*a*) What is ADT ?

(*b*) Define the term Omega Notation (Ω).

(*c*) List the types of priority queue.

(*d*) Consider operations performed on a stack push(1), push(2), pop, push(1), push(2), pop, pop, pop, push(2), pop. What is the sequence of popped out values are ?

(*e*) What is complete binary tree ?

(*f*) "A priority queue is implemented using array of stacks". State True *or* False.

P.T.O.

(*g*) State any *two* applications of graph.

(*h*) Define critical path.

(*i*) What is time complexity of Quick Sort ?

(*j*) Define AOV network.

2. Attempt any *two* of the following : [2×5=10]

(*a*) Write a recursive 'C' function to insert an element in binary tree.

(*b*) Write a 'C' program to implement stack using singly linked list.

(*c*) Write a 'C' program to implement circular queue as an array.

3. Attempt any *two* of the following : [2×5=10]

(*a*) Construct an AVL tree for the following data :

55, 40, 25, 100, 80, 200, 150.

(*b*) Sort the following data using bubble sort :

13, 12, 14, 15, 19, 9.

(*c*) Consider the following specification of a graph G :

V(G) = {1, 2, 3, 4}

E(G) = {(1, 2),(1, 3),(3, 3),(3, 4),(4, 1)}

(*i*) Draw a picture of the undirected graph.

(*ii*) Draw adjacency matrix of its.

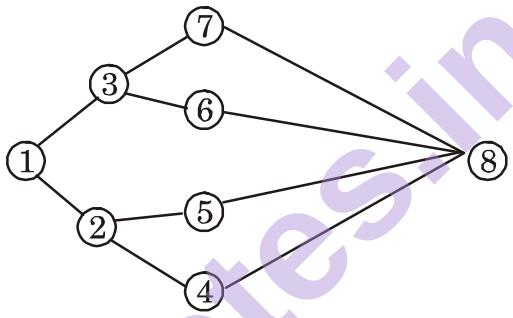
4. Attempt either A *or* B : [1×10=10]

(A) (*i*) Consider given infix expression ($u + v * w$). Write its postfix expression. Also show steps to evaluate the postfix expression using stack.

Given : $u = 3$, $v = 4$, $w = 2$. [4]

(*ii*) Write a short note on searching methods. [3]

(*iii*) Consider the following graph : [3]



Write :

(*a*) Adjacency list

(*b*) DFS and BFS (Source vertex 1).

Or

(B) (*i*) Define the following terms : [4]

(*a*) Acyclic graph

(*b*) Multigraph

(*c*) Spanning Trees

(*d*) Data structure.

(*ii*) Write a short note on Generalized linked-list. [3]

(*iii*) Write 'C' function to reverse a linked list. [3]

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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S.Y. B.Sc. (Computer Science) (I Sem.) EXAMINATION, 2018

COMPUTER SCIENCE

Paper – II

(CS-212 : Relational Database Management System)

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) *All* questions carry equal marks.

(*iv*) Assume suitable data, if necessary.

1. Attempt *all* of the following : [10×1=10]

(*a*) Define recoverable schedule.

(*b*) What is cursor ?

(*c*) List the components of client-server system.

(*d*) List the methods used for recovery from the deadlock.

(*e*) Define fat client.

(*f*) Define the term Polyinstantiation.

(*g*) List any *two* types of failures.

(*h*) What are *two* levels for assigning privileges for discretionary Access Control method ?

(*i*) List the error levels used in raise statement.

(*j*) What are the desirable properties of decomposition ?

P.T.O.

2. Attempt any *two* of the following : [2×5=10]

(*a*) Explain Two-phase Locking Protocol (2PL) and its variations.

(*b*) Explain Mandatory Access Control method in detail.

(*c*) List the armstrong axioms used to find closure of functional Dependency. Explain any *four* in detail.

3. Attempt any *two* of the following : [2×5=10]

(*a*) Consider the following relation schema :

Train (trainno, train_name, arrival_time, departure_time, no_of_bogies, bogie_capacity)

Write a stored function and trigger which will check in table for "arrival-time should be less than departure_time".

(*b*) Consider the following sequence of events in an interleaved execution of transactions T_1, T_2, T_3, T_4 with 2PL protocol. Find, is there a deadlock ? If yes, which transactions are involved in a deadlock.

Time	Transaction	Code
t_1	T_1	Lock (A, X)
t_2	T_2	Lock (B, S)
t_3	T_3	Lock (A, S)
t_4	T_4	Lock (B, S)
t_5	T_1	Lock (B, X)
t_6	T_2	Lock (C, X)
t_7	T_3	Lock (D, S)
t_8	T_4	Lock (D, X)

(*c*) Explain the services provided by a server component.

4. Attempt the following :

(*a*) Consider the following log at the time of system crash :

<T_1, start>
<T_1, X, 40>
<T_1, commit>
<Checkpoint>
<T_2, start>
<T_2, U, 80>
<T_3, start>
<T_3, Z, 40>
<T_2, commit>
System crash

If immediate update technique is used, what will be the recovery procedure ? [5]

(*b*) Consider the following :

R(A, B, C, G, H, I)

F(Set of Functional Dependency) = {A $\rightarrow$ B, A $\rightarrow$ C, CG $\rightarrow$ H, CG $\rightarrow$ I, B $\rightarrow$ H}

Find $(AG)^+$. [3]

Or

Consider the following relation :

R(ABCD) and F = {A $\rightarrow$ B, A $\rightarrow$ C, C $\rightarrow$ D). If R is decomposed into R_1(ABD) with F_1 = {A $\rightarrow$ B, A $\rightarrow$ D} and R_2(BC) with F_2 = {B $\rightarrow$ C}

Find the Decomposition is depdendency preserving or not. [3]

(*c*) List the various problems encountered when transactions run concurrently. [2]

Or

Give Thomas write rule. [2]

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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S.Y. B.Sc. (Computer Science) (I Semester) EXAMINATION, 2018

MATHEMATICS (Paper – I)

[MTC 211 : Applied Algebra)

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) Use of single memory, non-programmable scientific calculator is allowed.

1. Attempt any *five* of the following : [5×2=10]

(*i*) Determine if the vector $\overline{X} = \begin{bmatrix} -2 \\ -2 \\ 6 \end{bmatrix}$ is an eigenvector of the matrix :

$$A = \begin{bmatrix} 5 & 0 & 1 \\ 1 & 1 & 0 \\ -7 & 1 & 0 \end{bmatrix}$$

If yes, find the corresponding eigenvalue of A.

(*ii*) Write the definitions :

(*a*) Subspace of a vector space

(*b*) Linear transformation.

(*iii*) If the vectors $\overline{p} = 4 + 2x$ and $\overline{q} = \lambda + x$ of $\mathbf{P}_2$ are linearly dependent, then find the value of 'λ'.

P.T.O.

(*iv*) Write the definition of kernel of a linear transformation and determine if the vector $\bar{u} = (3, -4, -2)$ belongs to the kernel of the linear transformation $T : \mathbf{R}^3 \to \mathbf{R}^2$, defined as :

$$T(x, y, z) = (2x + y + z, -y + 2z).$$

(*v*) State dimension theorem for matrices and hence, if A is a 10×12 matrix of rank 8, then find nullity of A.

(*vi*) Find Hamming distance between the words $x = 10011011$ and $y = 11001110$.

(*vii*) Find the symmetric matrix A such that the quadratic form

$$y^2 - 3z^2 + 2xy - 4xz + 2yz$$

can be expressed in the form X^tAX.

2. Attempt any *two* of the following : [2×5=10]

(*i*) Consider the basis $S = \{(1, 1, 1), (1, 1, 0), (1, 0, 0)\}$ of $\mathbf{R}^3$. Find coordinate vector of the vector $\bar{u} = (1, -1, 2)$ relative to the basis S.

(*ii*) Determine if the set

$$W = \{a + bx/2a - 5b = 0\}$$

is a subspace of $\mathbf{P}_2$.

(*iii*) Find a basis of the subspace of $\mathbf{R}^4$ spanned by the vectors $\{\bar{u}_1, \bar{u}_2, \bar{u}_3\}$ and hence find its dimension; where $\bar{u}_1 = (1, -1, 2, 3)$, $\bar{u}_2 = (1, 2, 0, 1)$ and $\bar{u}_3 = (1, -4, 4, 5)$.

3. Attempt any *two* of the following : [2×5=10]

(*i*) Find a basis of the null-space of the following matrix :

$$A = \begin{bmatrix} 1 & -1 & 3 \\ 5 & -4 & -4 \\ 7 & -6 & 2 \end{bmatrix}$$

(*ii*) Write the definition of positive definite matrix and determine if the following matrix is positive definite :

$$A = \begin{bmatrix} 2 & -2 \\ -2 & -1 \end{bmatrix}$$

(*iii*) Consider the transformation

$$T : \mathbf{P}_1 \rightarrow \mathbf{R}^3$$

defined by :

$$T(a + bx) = (a - 2b,\ 7b,\ 2a + 3b)$$

Determine if T is a linear transformation.

4. Attempt any *one* of the following : [1×10=10]

(*i*) Determine whether the following matrix is diagonalizable

$$A = \begin{bmatrix} 1 & -3 & 3 \\ 3 & -5 & 3 \\ 6 & -6 & 4 \end{bmatrix}$$

If yes, find the matrix P that diagonalizes A.

(*ii*) (*a*) Suppose $A = \begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$ is a matrix of the linear transformation $T : \mathbf{R}^2 \rightarrow \mathbf{P}_1$ with respect to the bases $B = \{\bar{e}_1, \bar{e}_2\}$ for $\mathbf{R}^2$ and $B' = \{\bar{p}_1, \bar{p}_2\}$ for $\mathbf{P}_1$, where $\bar{e}_1 = (1, 0)$, $\bar{e}_2 = (0, 1)$ and $\bar{p}_1 = 1 - x$, $\bar{p}_2 = 1 + x$. Then compute $T\left(\begin{bmatrix} -1 \\ 1 \end{bmatrix}\right)$.

(*b*) Let

$$H = \begin{bmatrix} 1 & 1 \\ 0 & 1 \\ 1 & 0 \\ 0 & 1 \end{bmatrix}$$

be a parity check matrix. Determine (2, 4) code $e_H : B^2 \rightarrow B^4$.

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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S.Y. B.Sc. (Computer Science) (First Semester) EXAMINATION, 2018

MATHEMATICS

Paper II

(MTC-212 : Numerical Analysis)

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) Use of single memory non-programmable scientific calculator is allowed.

1. Attempt any *five* of the following : [5×2=10]

(*a*) Round off the number 75.34501 to five significant digits. Find the corresponding relative error and percentage error.

(*b*) Does the equation $x.e^x - 3 = 0$ have a real root in the interval (1,1.5) ? Justify your answer.

(*c*) With usual notation, show that $\delta^2 = \Delta - \nabla$.

(*d*) State Newton's divided difference interpolation formula.

P.T.O.

(*e*) Find $\int_0^{50} f(x)dx$, using Trapezoidal Rule :

x	y
0	0
10	1.41
20	2.44
30	3.46
40	4
50	4.51

where $y = f(n)$.

(*f*) Given $\frac{dy}{dx} = x + 1$ and $y(0) = 1$. Find $y(0.1)$ using Euler's method.

(*g*) State Bessel's interpolation formula.

2. Attempt any *two* of the following : [2×5=10]

(*a*) State and prove Simpson's $\frac{3}{8}$th rule for numerical integration.

(*b*) Calculate $\int_0^{\pi/2} e^{\sin x}dx$ correct to four decimal places using Simpson's $\frac{1}{3}$rd rule $\left(\text{Take } h = \frac{\pi}{12}\right)$.

(*c*) Using Euler's modified method, solve $\frac{dy}{dx} = x + y$. Given that $y_0 = 1$ when $x_0 = 0$. Find $y(0.05)$. (Take $h = 0.05$)

3. Attempt any *two* of the following : [2×5=10]

(*a*) State and prove Lagrange's interpolation formula.

(*b*) Using Gauss forward formula find y when $x = 30$ from the following table :

x	y
21	18.4708
25	17.8144
29	17.1070
33	16.3432
37	15.5154

(*c*) Estimate the missing terms in the following data :

x	y
2	135
2.1	?
2.2	111
2.3	100
2.4	?
2.5	82
2.6	74

4. Attempt any *one* of the following : [1×10=10]

(A) Evaluate the integral $\int_0^1 \frac{1}{1+x}dx$ using Euler-Maclaurin formula. (Take $h = 0.1$)

(B) (*i*) Given $\frac{dy}{dx} = 1 + y$, $y(0) = 0$. Find. $y(0.2)$ using Runge-Kutta second order method. (Take $h = 0.1$)

(*ii*) With usual notation, prove that :

$$\Delta \log f(x) = \log\left(1 + \frac{\Delta f(x)}{f(x)}\right).$$

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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[5423]-105

S.Y. B.Sc. (Computer Science) (First Semester) EXAMINATION, 2018

ELECTRONICS

Paper I

(ELC-211 : Digital System Hardware)

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Use of calculator is allowed.

1. Answer the following in one *or* two sentences each : [10×1=10]

(*a*) Draw three level memory hierarchy.

(*b*) What is priority interrupt ?

(*c*) Draw Harvard Architecture.

(*d*) Write BCD equivalent of decimal number 12.

(*e*) Find number of 'miss' if there are 78 hits in total 156 references of cache memory.

P.T.O.

(*f*) Draw state diagram of 3-bit up counter.

(*g*) What is the significance of 'Zero flag" in flag register of 8086 architecture ?

(*h*) Which are *three* types of buses in a computer system ?

(*i*) For common anode seven segment display, write decoding logic for *a, b, c, d, e, f, g* segments to display 4.

(*j*) Define "memory access time" of a memory.

2. Attempt any *two* of the following : [2×5=10]

(*a*) Draw truth table of full adder circuit. Hence design it using *k*-map and draw its circuit diagram.

(*b*) What is stack ? Explain register based stack organisation and the role of Stack Pointer (SP) in stack organisation.

(*c*) Using 256 × 4 memory chips, expand the memory to 1024 × 4.

3. Attempt any *two* of the following : [2×5=10]

(*a*) Explain how pipelining concept improves execution rate in advanced microprocessors.

(*b*) Explain direct mapping of cache memory.

(*c*) With the help of block diagram explain DMA controller.

4. Attempt any *one* of the following : [1×10=10]

(A) (*i*) What is the need of interface unit ? Draw and explain general input/output interface unit.

(*ii*) Draw and explain BIU (Bus Interface Unit) of 8086 processor.

Or

(B) (*i*) What is virtual memory ? Explain segmentation technique of virtual memory mapping.

(*ii*) Draw and explain 4-bit binary to gray converter using truth table.

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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S.Y. B.Sc. (Computer Science) (First Semester) EXAMINATION, 2018

ELECTRONICS

Paper II

(ELC-212 : Analog Systems)

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

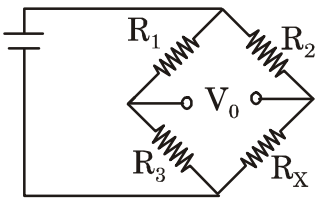
(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Use of calculator is allowed.

1. Answer the following questions in one *or* two sentences each : [10×1=10]

(*a*) What do you mean by first order filter ?

(*b*) Give the formula to calculate unknown resistance, R_x of bridge in balanced condition :



P.T.O.

(*c*) Draw the diagram of Inverting Amplifier Circuit.

(*d*) Define transducer.

(*e*) Name the fastest ADC.

(*f*) Plot the ideal frequency response of Band pass filter.

(*g*) What is Electrocardiography ?

(*h*) Define conversion time with respect to ADC.

(*i*) Name any *two* passive sensors.

(*j*) Give formula to calculate cut-off frequency of filter.

2. Attempt any *two* of the following : [2×5=10]

(*a*) Explain piezoelectric Humidity sensor with neat labeled diagram.

(*b*) Draw the circuit diagram of first order active high pass filter and explain frequncy response.

(*c*) Explain dual slope ADC with neat suitable diagram.

3. Attempt any *two* of the following : [2×5=10]

(*a*) Explain operating principle of pH sensor with suitable diagram.

(*b*) Draw the diagram of level shifter and derive an expression for output voltage.

(*c*) State any *five* features of LM-35 Temperature sensor.

4. Attempt any *one* of the following : [1×10=10]

(A) (*i*) With neat diagram explain principle of operation of ultrasonic sensor.

(*ii*) Draw diagram for 3-bit weighted resistive DAC.

Find :

(*a*) Full scale output

(*b*) O/p due to LSB change

Assume reference voltage = 10 V.

Or

(B) (*i*) Differentiate between Passive and Active Filters.

(*ii*) Explain Intruder detector system using PIR sensor with neat diagram.

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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S.Y. B.Sc. (Computer Science) (First Semester)

EXAMINATION, 2018

ENGLISH

(Technical English)

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

1. (A) Attempt any *one* of the following in about **100** words : [5]

(*i*) What is the difference between a planet and a star ?

(*ii*) What are the important causes which help civilized humans to live longer than the uncivilized ones ?

(B) Attempt any *one* of the following in about **100** words : [5]

(*i*) Why is Saturn said to be a world in the making ?

(*ii*) What are the problems that children who are 'at the mercy of five to six hours of television a day' face when they move into the real world ?

P.T.O.

2. (A) Attempt any *one* of the following in about **100** words : [5]

(*i*) Life changes for a girl, once she starts wearing the purdah : How does the poem *Purdah* build this idea ?

(*ii*) Bring out the various comparisons that Longfellow had made in the poem "*A Psalm of Life*".

(B) Attempt any *one* of the following in **100** words : [5]

(*i*) Write a detailed note on the symbolism in the poem '*Purdah*'.

(*ii*) Comment on the concluding stanza of the poem "*A Psalm of Life*".

3. (A) Give antonyms : [5]

(*i*) Virtues

(*ii*) Inumerable

(*iii*) Common

(*iv*) Interest

(*v*) Entrance.

(B) Choose the *correct* word : [5]

(*i*) Many of the pencils were [broke/broken].

(*ii*) Everybody [was/were] pleased with the result.

(*iii*) He is a little taller than [I/me].

(*iv*) The man could not do [nothing/anything].

(*v*) He received a [strong/hearty] welcome.

4. (A) Fill in the blanks with appropriate tense forms of verbs given in the bracket : [5]

(*i*) My father who is an Engineer ..... build houses.

[Simple Present]

(*ii*) Last night, while my friend ..... [take] a walk in the path, he saw a sanke.

[Past Progressive]

(*iii*) Raghav ..... (wait) at the airport when you reach Delhi tomorrow.

[Future Progressive]

(*iv*) The nature lover ..... (walk) through the woods.

[Simple Past]

(*v*) I ..... (write) an article next week.

[Simple Future Tense]

(B) Do as directed : [5]

(*i*) I went to see my cousin. His home was in the country.

[Simple into complex]

(*ii*) The boy lost his ticket because he was careless.

[Change into simple sentence]

(*iii*) What an exciting trip we had !

[Change into a declarative sentence]

(*iv*) Hasan said, "I am returning to Nagpur tomorrow".

[Change into direct speech]

(*v*) A documentary on the white tiger is being made by the Films Division.

[Change into active voice]

Total No. of Questions—**5**] [Total No. of Printed Pages—**5**

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[5423]-2

F.Y. B.Sc. (Computer Science) EXAMINATION, 2018

COMPUTER SCIENCE

Paper-II

CS-102 : File Organization and Fundamentals of Databases)

(2013 PATTERN)

Time : Three Hours **Maximum Marks : 80**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Assume suitable data, if necessary.

1. Answer *all* of the following : [10×1=10]

(*a*) What is a logical file ?

(*b*) Define TCL.

(*c*) Explain ternary relationship with example.

(*d*) What is the use of Having Clause in SQL ?

(*e*) Define partial dependency.

(*f*) What is left outer join ?

(*g*) Explain the term tuples with example.

(*h*) Define superkey.

(*i*) What is Clustering Index ?

(*j*) List the keywords used for set membership operation in nested queries.

P.T.O.

2. Attempt any *four* of the following : [4×5=20]

(*a*) Explain Hash file organization technique in detail.

(*b*) What is mapping cardinality ? What are its type ? Explain with example.

(*c*) Explain various types of users in DBMS.

(*d*) What is Normalization ? Write advantages of Normalization.

(*e*) Explain different types of integrity constraint.

3. Attempt any *four* of the following : [4×5=20]

(*a*) What are extended E-R features of E-R model ? Explain any *one* in detail.

(*b*) Write a short note on Data Abstraction.

(*c*) Explain in detail lossless decomposition with example.

(*d*) Explain Cartesian product and difference operation in relational algebra.

(*e*) Consider the relation R = (A, B, C, D, E) and set of FD's defined on R, F as $\{A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A\}$
Find all the superkey for relation R.

4. (A) Attempt any *three* of the following : [3×5=15]

(*a*) Consider the following relations :
Teacher (tno, tname, collegename, dept)
Etest (eno, testname)
Teacher and Etest are related with many to many relationship. Create a relational database in 3NF and solve the following queries in SQL :

(*i*) Count the number of teacher who passed 'set exam' of Physics.

(*ii*) Delete all the teacher of 'Botany' dept.

(*iii*) To print the total number of teachers passing respective exam.

(*b*) Consider the following relations :

Owner (licenceno, name, address, phoneno)

Car (carno, model, colour)

Owner and Car are related with one to many relationship. Create a relational database in 3NF and solve the following queries in SQL :

(*i*) Find the names of the owners of 'Indica' Car.

(*ii*) List all the models of owner 'Mr. Shinde' having colour 'Green'.

(*iii*) Delete the record of owner 'Mr. Pawar'.

(*c*) Consider the following relations :

Emp (eno, ename, salary, designation)

Dept (dno, dname, location)

Emp and Dept are related with many to one relationship. Create a relational database in 3NF and solve the following queries in SQL :

(*i*) List names of employee whose salary is between 25,000 to 30,000.

(*ii*) Find minimum salary having designation as 'Clerk'.

(*iii*) Update salary of employee by 15% who belong to History department.

(*d*) Consider the following relations :

Doctor (docno, docname, specialization)

Hospital (hospno, hospname, address)

Doctor and Hospital are related with many to many relation with attribute day-of-visit.

Create a relational database in 3NF and solve the following queries in SQL :

(*i*) List the name of the doctors visiting 'Birla Hospital' on Friday.

(*ii*) List the names of the hospitals in 'Mumbai' city which has more than 20 doctors of 'Surgeon' specially visiting it.

(*iii*) Delete all doctors with specialization 'gynaec'.

(B) Attempt any *one* of the following : [1×5=5]

(*a*) Consider the following relations :

Employee (empname, street, city)

Works (empname, companyname, salary)

Company (Companyname, city)

Solve the following queries in relational algebra.

(*i*) Find the name of employees who works for 'HDFC'.

(*ii*) Find names of cities of residence of all employees who works for 'SBI'.

(*iii*) Find the list of companies from Nagpur City.

(*iv*) Find the list of employees having salary more than Rs. 20,000.

(*v*) Find the list of employees who work in same city where they live.

(*b*) Consider the following relations :

Supplier (Sid, Sname, address);

Parts (Pid, Pname, Colour, Cost)

Catalog (Sid, Pid)

Solve the following queries in relational algebra :

(*i*) Find name of supplier who supply some green parts.

(*ii*) Find name of all parts whose cost is more than Rs. 600.

(*iii*) Find name of all parts whose colour is red.

(*iv*) Find name of supplier and parts with its colour and cost.

(*v*) Find name of supplier living in Delhi.

5. (A) In a nursery, the plants are sold to the customers. These plants are flowering and non-flowering. Nutrients are given to the plants with some quantity. Nutrients include pesticides, watering and manure.

(*i*) Design an E-R diagram.

(*ii*) Convert the E-R diagram into relational database in 3NF. [7]

(B) Write difference between single valued attribute and multivalued attribute. [3]

Or

Explain natural join with example. [3]

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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[5423]-201

S.Y. B.Sc. (CS) (Second Semester) EXAMINATION, 2018

CS-221 : OBJECT ORIENTED CONCEPT USING C++

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) *All* questions carry equal marks.

1. Attempt *all* of the following questions : [10×1=10]

(*a*) What is Object Oriented Programming ?

(*b*) Write a syntax of creating reference variable.

(*c*) What is use of get( ) and put( ) functions.

(*d*) Using inline function may reduce execution time, but may increase program size. State true/false.

(*e*) Define late binding.

(*f*) Write syntax of overloading << operator.

(*g*) What is purpose of generic catch block ?

(*h*) What is the order of execution of constructors

Class X, Public Y, Virtual Public Z

{

}

P.T.O.

(*i*) List different types of inheritance in C++.

(*j*) Give advantage of class template.

2. Attempt any *two* of the following questions : [2×5=10]

(*a*) Write a short note on new and delete operator.

(*b*) What is friend function ? Give syntax to declare a friend function. Give advantages and disadvantages of friend function.

(*c*) Write a program to overload binary operator '+' to add two complex numbers.

3. Attempt any *two* of the following : [2×5=10]

(*a*) What is purpose of virtual function ? State the rules for virtual function. Give example.

(*b*) Write a C++ program to accept data from a user till a character '#' is pressed. Write a data to a file "Output". Also display contents of file.

(*c*) Write a program to calculate the value of the following series using member functions

$$S = 1^2 + 2^2 + 3^2 + \ldots\ldots\ldots + n^2.$$

4. Attempt any *one* of the following (A *or* B) : [1×10=10]

(A) (*i*) Write a short note on this pointer. [4]

(*ii*) Explain syntax of parameterized constructor with example. [3]

(*iii*) List and explain file opening modes. [3]

Or

(B) (*i*) Explain exception Handling in C++ with example. [4]

(*ii*) Identify errors in the following code : [3]

```
Class A
{
    int x;
    void A(int x) {x = x_j}
    ~A (int x) {delete x_j};
};
```

(*iii*) Explain usage of manipulators. [3]

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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[5423]-202

S.Y. B.Sc. (Second Semester) EXAMINATION, 2018

COMPUTER SCIENCE

Paper II

(CS-222 : Software Engineering)

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) Neat diagrams must be drawn wherever necessary.

(*ii*) Figures to the right indicate full marks.

(*iii*) *All* questions carry equal marks.

(*iv*) *All* questions are compulsory.

1. Attempt all of the following : [10×1=10]

(*a*) List any *two* components of structured analysis.

(*b*) Define recovery testing.

(*c*) What is meant by astract system ?

(*d*) List any *two* umbrella activities of software engineering process framework.

(*e*) What are the basic activities involved in software coding phase ?

P.T.O.

(*f*) What is prescriptive process model ?

(*g*) Which people/person are called stakeholders of a system ?

(*h*) What is spike solution in XP ?

(*i*) What is the purpose of requirement traceability table ?

(*j*) What are the major activities of spiral process model ?

2. Attempt any *two* of the following : [2×5=10]

(*a*) Explain the characteristics of system in detail.

(*b*) Describe in detail the communication and planning activities of waterfall model ?

(*c*) Explain the human factors that must exists among the agile team.

3. Attempt any *two* of the following : [2×5=10]

(*a*) Explain prototyping process model in detail.

(*b*) Explain any *five* principles of software engineering proposed by David Hooker.

(*c*) Explain fact finding techniques in detail.

4. Attempt the following : [2×5=10]

(*a*) Explain preliminary investigation of system development lfie cycle in detail.

Or

(*a*) List the requirements engineering tasks and describe any *two* of them in detail.

(*b*) Draw a context level DFD and first level DFD for "Online shopping for a departmental store."

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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[5423]-203

S.Y. B.Sc. (Computer Science) (II Semester) EXAMINATION, 2018

MATHEMATICS

Paper I

(MTC-221 : Computational Geometry)

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) Use of single memory, non-programmable, scientific calculator is allowed.

1. Attempt any *five* of the following : [10]

(*i*) If we apply the transformation matrix $[T] = \begin{bmatrix} 3 & 1 \\ 2 & 2 \end{bmatrix}$, on a square then we get a parallelogram of area 64 cm^2. Find length of each side of the original square.

(*ii*) The line segment between the points A[–1, –3] and B[3, 4] is transformed to the line segment A′B′ by the transformation matrix $[T] = \begin{bmatrix} -1 & 4 \\ 4 & 2 \end{bmatrix}$. Find the midpoint of A′B′.

(*iii*) What is a solid body transformation ? Give example.

P.T.O.

(*iv*) Obtain the transformation matrix for a cavalier projection for $\alpha = 45°$.

(*v*) Determine the foreshortening factors f_x and f_y if the transformation matrix for axonometric projection is :

$$\begin{bmatrix} 0.5 & 0.43 & 0 & 0 \\ 0 & 0.86 & 0 & 0 \\ -0.86 & 0.25 & 0 & 0 \\ 3.58 & 0.75 & 0 & 1 \end{bmatrix}.$$

(*vi*) State any *two* properties of Bézier curve.

(*vii*) Find the value of $\delta\theta$ to generate uniformly spaced 10 points on the parabolic segment in the first quadrant for $1 \leq X \leq 4$ for the parabola $X = \theta^2$, $y = 2\theta$.

2. Attempt any *two* of the following : [10]

(*i*) Derive the transformation matrix for rotation about the origin through an angle 'θ'.

(*ii*) Rotate the line segment between the points A(2, –5) and B(–6, 11) about its midpoint through an angle $\left(\frac{\pi}{4}\right)^C$.

(*iii*) Determine through what angles the plane X + Y + Z = 0 be rotated about the X-axis and then about the Y-axis, so that it coincides with the Z = 0 plane.

3. Attempt any *two* of the following : [10]

(*i*) Derive the rotation angle 'ϕ' about Y-axis and rotation angle 'θ' about the X-axis in dimetric projection for the given principle foreshortening factor f_z along z-axis.

(*ii*) Find the concatenated transformation matrix for first scaling in X and Z co-ordinates by factors 4 and 6 respectively, followed by single point perspective projection onto the $y = 0$ plane from centre of projection at $y_c = 20$ on the Y-axis. Apply this transformation onto the point P(2, 2, –1).

(*iii*) Obtain the transformation matrix for the trimetric projection formed by rotation about the Y-axis through an angle $\phi = 30°$, followed by rotation about the X-axis through an angle $\theta = 45°$ and then orthographic projection on the $z = 0$ plane. Also determine the principal foreshortening factor.

4. Attempt any *one* of the following : [10]

(*i*) (*a*) Write an algorithm for reflection through the line $y = mx + c$.

(*b*) Find the parametric equation of a Bézier curve determined by control points $B_0[2\ 1]$, $B_1[4\ 3]$, $B_2[6\ 0.5]$ and hence find the position vector of the point corresponding to parameter value $t = 0.43$.

(*ii*) Find uniformly spaced 8 points of the ellipse, $\frac{(X-2)^2}{4} + \frac{(y-2)^2}{1} = 1$ inclined 30° to X-axis.

Total No. of Questions—**4**] [Total No. of Printed Pages—**6**

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S.Y. B.Sc. (Computer Science) (II Semester) EXAMINATION, 2018

MATHEMATICS

Paper II

(MTC-222 : Operations Research)

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) Use of single memory, non-programmable, scientific calculator is allowed.

1. Attempt any *five* of the following : [10]

(*i*) Use north-west corner rule to find IBFS of the following transportation problem :

	D_1	D_2	D_3	Supply
O_1	5	3	12	60
O_2	3	10	4	40
O_3	3	5	1	40
Demand	30	65	45	

P.T.O.

(*ii*) Find range of values of K that will render the entry (2, 2) a saddle point in the following game :

Player B

Player A		B_1	B_2	B_3
	A_1	2	4	5
	A_2	10	7	8
	A_3	4	K	6

(*iii*) Draw region of the following LPP :

Maximize :

$$Z = 2x + 3y$$

Subject to :

$$-x + y \geq 2$$

$$x - y \geq 2$$

$$x, y \geq 0.$$

(*iv*) Write dual form of the following LPP :

Maximize :

$$Z = 15x_1 + x_2$$

Subject to :

$$x_1 + 2x_2 \leq 10$$

$$2x_1 + 3x_2 = 12$$

$$x_1, x_2 \geq 0.$$

(*v*) Solve the following assignment problem for minimization :

		Jobs		
		I	**II**	**III**
Operators	A	7	6	5
	B	3	7	3
	C	2	9	7

(*vi*) Write standard form of the following LPP :

Maximize :

$$Z = -2x_1 - 4x_2 - x_3$$

Subject to :

$$x_1 + 2x_2 - x_3 \leq 5$$

$$2x_1 - x_2 + 2x_3 = 2$$

$$-x_1 - 2x_2 + 3x_3 \geq 1$$

$$x_1, x_2, x_3 \geq 0.$$

(*vii*) Write any *two* applications of operations research.

2. Attempt any *two* of the following : [10]

(*i*) Using simplex method show that the following LPP has unbounded solution :

Maximize :

$$Z = 2x_1 + 3x_2$$

Subject to :

$$-3x_1 + x_2 \leq 4$$

$$x_1 - x_2 \leq 2$$

$$x_1, x_2 \geq 0.$$

(*ii*) Solve the following assignment problem to minimize the cost such that machine M_2 cannot be assigned Job-C and machine M_3 cannot be assigned Job-A :

		Jobs				
		A	**B**	**C**	**D**	**E**
Machines	M_1	9	11	15	10	11
	M_2	12	9	–	10	9
	M_3	–	11	14	11	7
	M_4	14	8	12	7	8

(*iii*) Solve the following transportation problem by matrix minima method :

		Destinations				
		D_1	D_2	D_3	D_4	Supply
Origins	O_1	30	25	40	20	100
	O_2	29	26	35	40	250
	O_3	31	33	37	30	150
	Demand	90	160	200	50	

3. Attempt any *two* of the following : [10]

(*i*) Solve the following game by using principle of dominance :

		Player B					
		I	**II**	**III**	**IV**	**V**	**VI**
Player A	1	4	2	0	2	1	1
	2	4	3	1	3	2	2
	3	4	3	7	–5	1	2
	4	4	3	4	–1	2	2
	5	4	3	3	–2	2	2

(*ii*) Solve the following assignment problem for minimum cost :

	I	II	III	IV	V
A	25	18	32	20	21
B	34	25	21	12	17
C	20	17	20	32	16
D	20	28	20	16	17

(*iii*) A firm manufactures headache pills in two sizes A and B. Size A contains 2 grains of aspirin, 5 grains of bicarbonate and 1 grain of codeine. Size B contains 1 grain of aspirin, 8 grains of bicarbonate, and 6 grains of codeine. It is found by user that it requires at least 12 grains of aspirin, 74 grains of bicarbonate and 24 grains of codeine for providing immediate effect. It is required to determine the least number of pills, a patient should take to get immediate relief.

Formulate the problem as a LPP and solve it graphically.

4. Attempt any *one* of the following : [10]

(*i*) (*a*) Solve the following game graphically :

		Player B		
		I	II	III
Player A	I	6	7	15
	II	20	12	10

(*b*) The following is an IBFS of a transportation problem. Check whether it is optimal. If not, find optimal solution by MODI method :

	D_1	D_2	D_3	D_4
W_1	6 (35)	1 (35)	9	3
W_2	11 (5)	5	2 (50)	8
W_3	10 (45)	12	4	7 (45)

(*ii*) Solve the following LPP by Big-M method :

Minimize :

$$Z = 8x_1 + 10x_2$$

Subject to :

$$8x_1 + 6x_2 \geq 150$$

$$2x_1 + 9x_2 \geq 120$$

$$x_1, x_2 \geq 0.$$

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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[5423]-205

S.Y. B.Sc. (Computer Science) (Second Semester)

EXAMINATION, 2018

ELECTRONIC SCIENCE

Paper I

(ELE-221 : The 8051 Architecture, Interfacing and Programming)

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of calculator is allowed.

1. Attempt *All* of the following in short : [10×1=10]

(*a*) What is the function of ALE pin of 8051 ?

(*b*) Mention Onchip ROM capacity of 8051.

(*c*) Which is the highest priority interrupt in 8051 ?

(*d*) List any *two* registers used for serial communication.

(*e*) Which pin of LCD is used to control the contrast ?

P.T.O.

(*f*) Mention any *two* differences between controller and processor.

(*g*) State any *two* addressing modes.

(*h*) Define step anlge of stepper motor.

(*i*) What is the function of Assembler directive "Org" ?

(*j*) Mention any *two* features of ARM processor.

2. Attempt any *two* of the following : [2×5=10]

(*a*) Draw structure of a port pin and explain how reading and writing operation is performed using port pins ?

(*b*) Write 8051, C-program to generate square wave on $P_{2.5}$ having 2 kHz frequency and 50% duty cycle. Assume X_{TAL} freq. = 12 MHz (The value to be loaded into timer register FF06H)

[Use Timer 1 in Mode 1.]

(*c*) Draw block diagram for interfacing DAC with 8051 and write 'C' program to generate triangular wave.

3. Attempt any *two* of the following : [2×5=10]

(*a*) Explain the functions of the following instructions :

(*i*) NOP

(*ii*) ANL A, R_5

(*iii*) MOVA, @ R_0

(*iv*) SETB $P_{1.6}$

(*v*) JNZ addr.

(*b*) Explain any *five* features of 8051 µC.

(*c*) Explain the interrupts of 8051 µC.

4. Attempt any *one* of the following : [1×10=10]

(*a*) (*i*) Draw a neat diagram to show how LCD is interfaced to 8051. Write a 'C' program to display the message "ELECTRONICS". [6]

(*ii*) Write a program to read the status of switch connected to $P_{2.0}$ if it is 'O' switch off the LED connected to $P_{1.7}$. [4]

Or

(*b*) (*i*) Explain how LED can be interfaced to port $P_{1.2}$ of 8051 µC with neat diagram. Write a program to blink the LED. [5]

(*ii*) Draw bit format of Interrupt Enable (IE) register and explain function of each bit. [5]

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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[5423]-206

S.Y. B.Sc. (Computer Science) (Second Semester)

EXAMINATION, 2018

ELECTRONICS

Paper II

(ELC-222 : Communication Principle)

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) Neat diagram must be drawn wherever necessary.

(*iv*) Use of calculator is allowed.

1. Answer the following in *one* or *two* sentences : [10×1=10]

(*a*) What are different elements of RFID system ?

(*b*) Define simplex communication system and give *one* example.

(*c*) What is delta modulation ?

(*d*) Name basic blocks of general communication system.

(*e*) Draw constellation diagram of QPSK.

P.T.O.

(*f*) Define "dwell time" w.r.t. FHSS technology.

(*g*) Find out modulation index of AM, if modulating signal $v_m = 10 \sin (5k \times 2\pi t)$ is modulated using carrier signal $v_c = 20 \sin (100k \times 2\pi t)$.

(*h*) Compare synchronous and asynchronous transmission. (any *two* points).

(*i*) Define radiation pattern of an antenna.

(*j*) In FDM telephony system, how many subscribers can be combined in basic group ?

2. Answer any *two* of the following : [2×5=10]

(*a*) With the help of diagram, explain PCM modulator and demodulator.

(*b*) Explain the following terms w.r.t. communication system :

(*i*) Channel Bandwidth

(*ii*) Data Rate

(*iii*) Baud Rate

(*iv*) Signal to Noise Ratio

(*v*) Nyquist Sampling theorem.

(*c*) Write any *five* features of TDMA.

3. Answer any *two* of the following : [2×5=10]

(*a*) Draw and explain working of GSM architecture.

(*b*) Describe basic concept of TDM with the help of block diargam.

(*c*) Obtain output expression for AM mathematically. Hence draw frequency spectrum of AM.

4. Attempt any *one* of the following : [1×10=10]

(*a*) (*i*) Why is error coding required in communication system ? Explain steps involved in constructing Hamming code.

(*ii*) What is "cell" in cellular mobile system ? Explain frequency reuse concept with respect to mobile communication. How does "Hand off" take place in mobile communication system ?

Or

(*b*) (*i*) Explain working principle of DSSS.

(*ii*) Explain FSK modem with the help of block diagram.

Total No. of Questions—**4**] [Total No. of Printed Pages—**2**

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S.Y. B.Sc. (Computer Science) (Second Semester)
EXAMINATION, 2018
ENGLISH
(EN-221 : Technical English)
(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.
(*ii*) Figures to the right indicate full marks.

1. (A) Attempt any *one* of the following in about **100** words : [5]

(*i*) Describe the character of Rosemary Fell.

(*ii*) How did the poor, thin girl react to Rosemary's invitation ?

(B) Attempt any *one* of the following in about **100** words : [5]

(*i*) How did the narrator react to the changes made to his features in the photograph ?

(*ii*) Bring out the humour from the story *With the Photographer*.

2. (A) Attempt any *one* of the following in about **100** words : [5]

(*i*) Describe the emotions that still remain on the face of sculpture in the poem *Ozymandias*.

(*ii*) Bring out the significance of the title of the poem "*If*".

P.T.O.

(B) Attempt any *one* of the following in about **100** words : [5]

(*i*) According to the poem "*If*", what are the challenges that a person will have to face in life.

(*ii*) Describe Daffodils as a nature poem.

3. Attempt any *two* of the following : [10]

(*i*) Frame *five* interview questions along with their probable responses for the post of a Software Engineer.

(*ii*) Jatin, Lalit, Ajay and Atul are discussing "the impact of films on the society". Write a transcript of the discussion in a dialogue form.

(*iii*) Prepare a PowerPoint Presentation of *five* slides on "Preventive Measures for Swine Flu".

(*iv*) Write a note on the use of Audio-Visual Aids for preparing a PowerPoint Presentation.

4. Attempt any *two* of the following : [10]

(*i*) Develop a paragraph on "Selfie Mania".

(*ii*) Write an essay on "History and Historical Films".

(*iii*) Write a review of the film that you have seen recently.

(*iv*) Write a report on the "Cultural Week" celebrated at your college.

Total No. of Questions—**5**] [Total No. of Printed Pages—**5**

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[5423]-3

F.Y. B.Sc. (Computer Science) EXAMINATION, 2018

MATHEMATICS

Paper I

(MTC-101 : Discrete Mathematics)

(2013 PATTERN)

Time : Three Hours **Maximum Marks : 80**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Use of non-programmable scientific calculator is allowed.

1. Attempt any *eight* of the following : [16]

(1) Find the permutation of the given set {1, 2, 3, 4} taking two elements at a time.

(2) Write recurrence relation for the sequence 2, 5, 8, 11, ...

(3) Draw the bipartite graph which is not regular graph.

(4) Determine the following statement is True *or* False with justification :

"Every disconnected graph has an isolated vertex".

(5) How many bridges T contains if T is spanning tree of k_9 ?

(6) Define complemented lattice. Give an example.

(7) Write the following statement in symbolic form :

"India is friendly nation for Nepal".

(8) Find the number of ways to arrange the letters of the word 'MATHEMATICS'.

P.T.O.

(9) Define binary tree and write its *one* property.

(10) Construct a simple graph G, such that $k(G) = \lambda(G) = \delta(G) = 2$.

2. Attempt any *four* of the following : [16]

(1) Test the validity of the following argument by the method of direct proof :

$$p \to q, r \to \sim t, p \vee r, t \vdash q$$

(2) Draw Hasse diagram of D_{42} with respect to partial ordering relation divides.

(3) How many four-digit numbers can be formed from the digit 1, 2, 3, 4 and 5 with repetition, which are divisible by 5.

(4) Suppose 60% of college professors like tennis, 65% like bridge, 50% like chess and 45% like any given pair of recreations.

(*a*) Should you be suspicious if told 20% like all the three recreations ?

(*b*) What is smallest percentage who could like all the three recreations ?

(5) Consider the recurrence relation :

$a_n = a_{n-1} + 2\ a_{n-2}$, $a_9 = 3$ and $a_{10} = 5$.

Find a_7 and a_{12}.

(6) Translate the following into symbolic form :

(*a*) Some horses run faster than some cars.

(*b*) All integers are rationals.

3. Attempt any *two* of the following : [16]

(1) Write the Boolean expression :

$F(x, y, z) = (x \wedge y) \vee (\overline{x} \vee z) \vee (\overline{y} \wedge z)$ in disjunctive normal form.

(2) Find number of integers between 1 and 2100 that are divisible by 2 or 3 or 7.

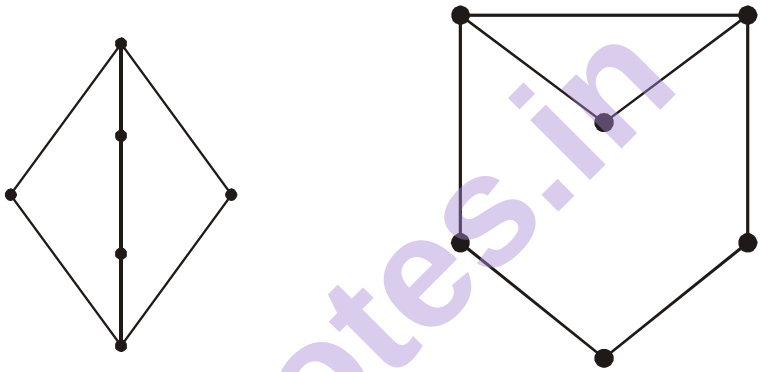
(3) Let a_n be the recursive relation defined by $a_n = a_{n-1} + a_{n-2} + a_{n-3}$, $n \geq 3$ with initial conditions $a_0 = a_1 = a_2 = 1$.

(a) Obtain a_3, a_4, a_5, a_6.

(b) Prove that $a_n \leq 2^{n-1} \forall\ n \geq 1$

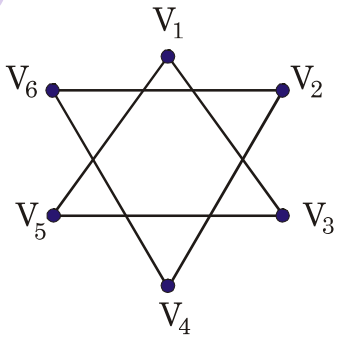
4. Attempt any *four* of the following : [16]

(1) Determine whether the following graphs are isomorphic or not. Justify.



$G_1 \ncong G_2$.

(2) Is the following graph a complete graph ? Justify your answer.



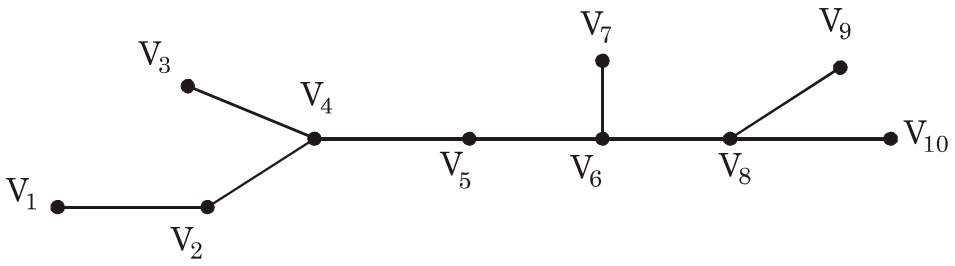
(3) Find the vertex connnectivity and edge connectivity of the complete graph k_n and hence find vertex and edge connectivity of k_5.

(4) Give an example of the following :

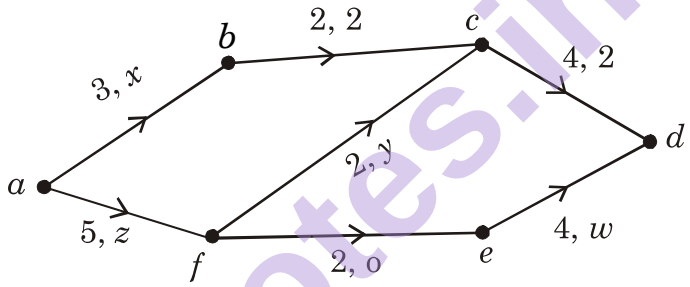
(a) Eulerian as well as Hamiltonian graph.

(b) Not Eulerian but Hamiltonian graph.

(5) Find centre and radius of T for the following graph :

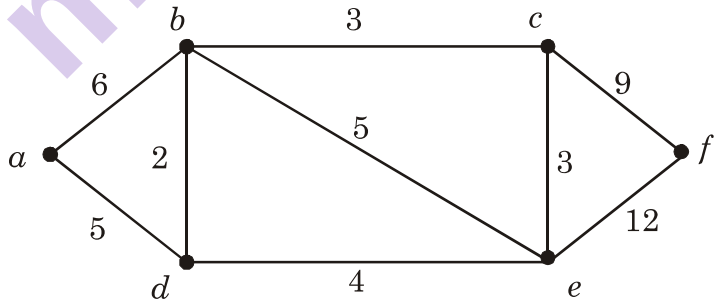


(6) In the following network, fill the missing figures so that the result is a flow in the given network. Find also the value of the flow :



5. Attempt any *two* of the following : [16]

(1) Using Dijkstra's algorithm find shortest path from vertex '*a*' to all other vertices in the following graph G.

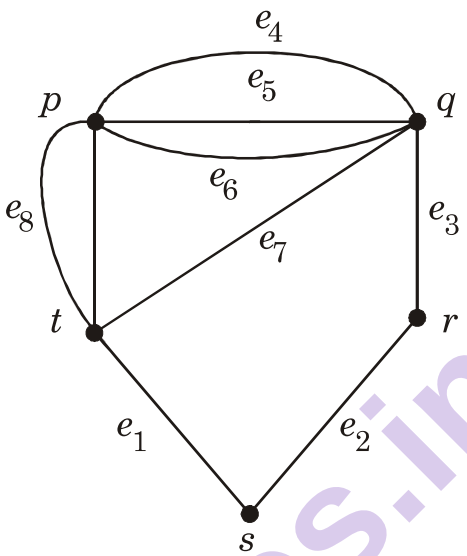


(2) Let T be a graph on n vertices and with m edges, then prove that the following statements are equivalent :

(a) T is a tree.

(b) T has no circuits and $m = n - 1$.

(3) Find adjacency and incidence matrix of the following graph :



Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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T.Y. B.Sc. (III Semester) EXAMINATION, 2018
COMPUTER SCIENCE
Paper-I
(CS-331 : System Programming)
(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.
(*ii*) Figures to the right indicate full marks.
(*iii*) Neat diagrams must be drawn wherever necessary.

1. Attempt *all* of the following : [10×1=10]

(*a*) List any *two* system software.
(*b*) Give *two* examples of structure editor.
(*c*) 'ORIGIN' is imperative statement. Say True/False and Justify.
(*d*) What is the meaning of the following statement in assembly language ?
TEN DC '10'.
(*e*) What is the use of Macro expansion counter ?
(*f*) Write the difference between compiler and interpreter.
(*g*) Define the term Linking.
(*h*) List the types of debugger with example.
(*i*) What factors should be considered while designing operating system for hand-held system ?
(*j*) Which system calls are used by operating system to read data from file ?

2. Attempt any *two* of the following : [2×5=10]

(*a*) Give the usage of the following statements with its syntax :
AIF, AGO, ANOP, LCL, SET.

P.T.O.

(*b*) For the following assembly language program show the intermediate code according to variant-I and variant-II :

```
        START 350
        READ  A
        READ  B
BACK    MOVER AREG, A
        MOVER CREG, = '15'
        BC    ANY BACK
        LTORG
    MOVER AREG = '66'
    ORIGIN 425
ADD CREG, B
    PRINT A
    STOP
    A DS 2
    B DS 1
  END.
```

Instruction Opcode	Assembly mnemonics
00	STOP
01	ADD
02	MOVER
03	BC
04	READ
05	PRINT

(*c*) Explain the term 'public definition' and 'External reference' in the context of linking.

3. Attempt any *two* of the following : [2×5=10]

(*a*) What are the task of analysis phase and synthesis phase in assembly process ?

(*b*) For the following macro make the entries in the following data structure :

(*i*) MNT

(*ii*) EVNTAB

(*iii*) MDT

(*iv*) PNTAB

(*v*) KPDTAB

```
MACRO
    INCR &A, &B, &RFG = BREG
    LCL &M
 &M SET 1
    MOVER &REG, &A
    MOVER &REG, &B +1
    MOVER &REG, &A + &M
 MEND.
```

(*c*) Explain any *two* operating system components.

4. Attempt either (A) *or* (B) : [10]

(A) (*a*) Define system program. Differentiate between system programming and application programming. [4]

(*b*) How are nested macro calls are implemented by macro preprocessor ? [3]

(*c*) Explain the functions of DDD. [3]

(B) (*a*) Define the following terms : [4]

(*i*) Load origin

(*ii*) Link origin

(*iii*) Address sensitive instructions

(*iv*) Relocation factor.

(*b*) Explain any *three* commands of line editor. [3]

(*c*) What is system call ? Explain the system call for process and job control. [3]

Total No. of Questions—4] [Total No. of Printed Pages—4

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[5423]-302

T.Y. B.Sc. (Third Semester) EXAMINATION, 2018

COMPUTER SCIENCE

Paper II

(CS-332 : Theoretical Computer Science)

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) Neat diagram must be drawn wherever necessary.

(*ii*) Figures to the right indicate full marks.

(*iii*) *All* questions carry equal marks.

(*iv*) *All* questions are compulsory.

1. Attempt *all* of the following : [10×1=10]

(*a*) Define Turing Machine (T.M.).

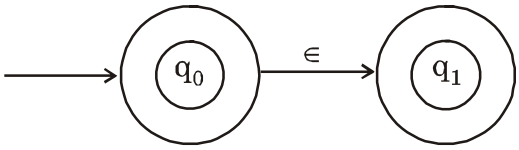
(*b*) Define suffix of a string. Give *one* example.

(*c*) Compare 'λ' function of Melay and Moore machine.

(*d*) DFA may have many final states. Comment.

P.T.O.

(*e*) Write down the 'E-closure' of each state from the following FA :



(*f*) Define ambiguous grammar.

(*g*) Write a mapping of δ in PDA.

(*h*) State *two* differences between TM and LBA.

(*i*) Write the smallest possible string accepted by regular expression : (0 + 1)* 01*.

(*j*) What are the types of grammar in Chomsky hierarchy ?

2. Attempt any *two* of the following : [2×5=10]

(*a*) Construct DFA for L = $L_1 \cap L_2$ where

L_1 = all strings starting with '*b*' over {*a*, *b*}

L_2 = all strings not having '*ba*' as substring over {*a*, *b*}.

(*b*) Convert the following grammar in CNF :

S → ABA

A → aA/∈ (epsilon)

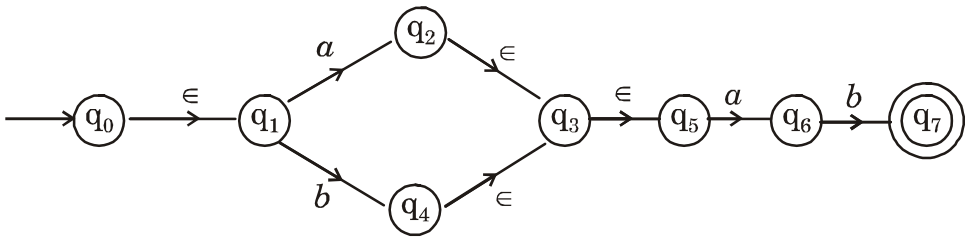
B → bB/∈ (epsilon).

(*c*) Construct PDA for language :

$$L = \{a^n b^{2n+1} \mid n \geq 1\}.$$

3. Attempt any *two* of the following : [2×5=10]

(*a*) Convert the following NFA to DFA :



(*b*) Construct TM accepting language

$$L = \{a^n b^m c^{m+n} \mid m, n \geq 0\}.$$

(*c*) Convert the following grammer in GNF :

S → AB | B

A → BS

B → AI | I

4. Attempt (A) *or* (B) : [1×10=10]

(A) (*i*) Construct the minimize DFA for the following DFA

M = $(\{q_0, q_1, q_2, q_3, q_4\}, \{a, b\}, \delta, q_0 \{q_2, q_4\})$

	δ	*a*	*b*
Start →	q_0	q_1	q_2
	q_1	q_1	q_3
Final	← q_2	q_0	q_1
	q_3	q_1	q_4
Final	← q_4	q_3	q_1

(Use Myhill Nerode Theorem). [4]

(*ii*) Construct FA for the following regular expression :

$$(010 + 00)^* (10)^*.$$ [4]

(*iii*) Explain types of regular grammar. [2]

Or

(B) (*i*) Construct Moore machines for binary input sequence such that if it has a substring 101, the machine output 'A', if it has substring 110 then output 'B' else output 'C'. [4]

(*ii*) Construct CFG for ;

(*a*) $\{a^n b^m \mid n, m \geq 0\}$

(*b*) $\{a^n b^n c^i \mid n \geq i, i \geq 0\}$. [4]

(*iii*) Differentiate between FA and PDA. [2]

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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T.Y. B.Sc. (Computer Science) (Third Semester)

EXAMINATION, 2018

COMPUTER SCIENCE

Paper III

(CS-333 : Computer Network-I)

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) Use of calculator/log tables is allowed.

1. Attempt all of the following questions : [10×1=10]

(*a*) Define protocols. What are its key elements ?

(*b*) List some application layer protocols.

(*c*) List the examples of unguided media.

(*d*) If the bandwidth of the channel is 10 kbps, how long does it take to transmit a frame of 100000 bits ?

(*e*) What is flow control ? Why is it needed ?

P.T.O.

(*f*) Define contention system.

(*g*) Which topology requires a multipoint connection ?

(*h*) List the connectors used with fiber optic cables.

(*i*) Which device operates in physical layer ?

(*j*) Which error detection method uses ones complement arithmetic ?

2. Attempt any *two* of the following : [5×2=10]

(*a*) State and explain the difference between LAN and WAN.

(*b*) Explain coaxial cable and give its applications, advantages and disadvantages.

(*c*) Calculate the total delay for a frame of size 5 million bits which is sent on a link with 10 routers, each having queuing time 2 μs and a processing time of 1 μs. The length of the link is 2000 km and speed of light is 2×10^8 m/s in the link. The link has bandwidth 5 mbps.

3. Attempt any *two* of the following : [5×2=10]

(*a*) Explain the similarities and differences between OSI and TCP/IP reference model.

(*b*) What is parallel transmission ? State their advantages and disadvantages.

(*c*) Given 12 bit sequence 110111100101 and a divisor of 1001. Find the CRC.

4. Attempt A *or* B of the following :

(A) (*i*) What is framing ? Explain any *two* framing methods with examples. [5]

(*ii*) Write a note an Reservation method used in controlled access. [3]

(*iii*) Define physical and logical address. [2]

Or

(B) (*i*) What is channelization ? List *three* channelization methods and explain any *one* method. [5]

(*ii*) Explain PPP protocol with their frame format. [3]

(*iii*) State the advantages and disadvantages of star topology. [2]

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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T.Y. B.Sc. (III Semester) EXAMINATION, 2018
COMPUTER SCIENCE
Paper-IV
CS-334 : Internet Programming–I)
(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.
(*ii*) *All* questions carry equal marks.

1. Attempt the following : [10×1=10]

(*a*) What is the role of web server and web browser ?

(*b*) State True/False :
"The names of user-defined classes and functions as well as built-in constructs are case-insensitive.

(*c*) Differentiate between single-quoted string and double-quoted string.

(*d*) What is serialization ?

(*e*) Write the output of the following PHP script :

```
$str = 'abc, pqr, lmn, xyz';
$a = explode(' , ' , $str, 3);
print-r($a);
```

(*f*) Which function is used to remove duplicate elements from an array ?

(*g*) How to access data members of a class inside member function ?

(*h*) State the advantage of using PEAR DB functions.

(*i*) How to move back to the first entry in a given directory while working with it ?

P.T.O.

(*j*) Write the output of the following PHP script :

```
function change( )
{ $cnt ++; }
$cnt = 20;
change( );
echo $cnt;
```

2. Attempt any *two* of the following : [2×5=10]

(*a*) Explain scope of a variable in PHP with suitable example.

(*b*) Consider a table student (rno, name, class). Assume database stud already exists. Write a PHP script to accept a student roll no. and display details of that student using PEAR DB functions.

(*c*) Write a PHP script to define class vector with size and integer elements. Define a construction to initialize the object. Accept vector elements and its size from user. Also write member functions to display its elements.

3. Attempt any *two* of the following : [2×5=10]

(*a*) How to get array of keys and array of values from an associative array ? Illustrate with suitable example using built-in functions.

(*b*) Consider a string $str = "PUNE UNIVERSITY"; write a PHP script to display above string in the format given below using built-in function :

(1) pune university
(2) PUNE UNIVERSITY
(3) Pune university
(4) Pune University
(5) Pune University***

(*c*) Explain the following functions with respect to a file :

(1) filectime()
(2) file()
(3) stat ()
(4) unlink()
(5) fwrite()

4. Attempt any *one* (A) *or* (B) :

(A) (*a*) What is an Anonymous function ? How is it different from normal function ? [4]

(*b*) Write a PHP script to accept a file name from user and display last access date and time of a file. [4]

(*c*) Write the output of the following PHP script ;

```
< & php
$ age = array ("Peter" ⇒ "35", "Ben" ⇒ "37", "Joe" ⇒ "43");
arsort ($ age);
print-r ($ age);
```

[2]

Or

(B) (*a*) How to pass parameters to a function by reference ? Explain with example. Aslo write its advantage. [4]

(*b*) Explain the following function : [4]

(1) array-flip( )

(2) array-filter( )

(3) is-object( )

(4) die( )

(*c*) Explain the concept of extends and implements with class. [2]

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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T.Y. B.Sc. (Computer Science) (Third Semester)

EXAMINATION, 2018

CS-335 : PROGRAMMING IN JAVA-I

Paper V

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) Neat diagram must be drawn wherever necessary.

1. Attempt *all* of the following : [10×1=10]

(*a*) What is the use of javap tool ?

(*b*) What is blank final variable ?

(*c*) "Java is platform dependant language." True/False ? Justify.

(*d*) Write down syntax for equals() method.

(*e*) What is deep copy in cloning ?

(*f*) State the use of toString() method.

(*g*) What is the use of finally block ?

P.T.O.

(*h*) Which method is used to set the current position of the file pointer within the file.

(*i*) State any *four* methods of WindowListener.

(*j*) Which method is used for first time initialization in applet ?

2. Attempt any *two* of the following : [5×2=10]

(*a*) Write a java program to implement operations of queue which is of the fixed size. It uses an interface queue, containing two methods addq() and delq(), which are implemented by queue class.

(*b*) Write a java program to create a package named student. Define class studentInfo with method to display information about student such as rollno, name, class and percentage. Create another class studentPer with method to find percentage of the student. Accept student details like rollno, name, class and marks of three subject from user.

(*c*) What is stream ? Explain the types of streams supported by java.

3. Attempt any *two* of the following : [2×5=10]

(*a*) Write a java program to accept the details of product as productcode, productname and weight. If weight > 100 then throw an exception as InvalidProduct Exception and give the proper message. Otherwise display the product details. Define required exception class.

(*b*) How is menu created in java ? Explain with suitable example.

(*c*) Explain inner class with an example.

4. Attempt A *or* B of the following :

(A) (*i*) What is the use of Checkboxes and RadioButtons ? Explain with suitable example. [4]

(*ii*) Explain the Applet Life Cycle. [4]

(*iii*) What is checked and unchecked exceptions ? [2]

Or

(B) (*i*) Explain Layout Managers used in AWT. [4]

(*ii*) Write a java program to display the contents of the file in reverse order. [4]

(*iii*) Write down any *two* differences between the abstract class and interface. [2]

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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T.Y. B.Sc. (Computer Science) (Third Semester)

EXAMINATION, 2018

CS-336 : OBJECT ORIENTED SOFTWARE ENGINEERING

Paper VI

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) Neat diagram must be drawn wherever necessary.

(*ii*) Figures to the right indicate full marks.

(*iii*) *All* questions carry equal marks.

(*iv*) *All* questions are compulsory.

1. Attempt *all* the following : [10×1=10]

(*a*) "Classes may called as object type". State True *or* False and justify in short.

(*b*) Define an object "Electricity Bill" with possible attributes and operations with visibility.

(*c*) Define Association.

(*d*) Define Leaf Class.

(*e*) What is purpose of use case view ?

P.T.O.

(*f*) Write any *two* phases of RUP (Rational Unified Process).

(*g*) Name the types of diagram used by Booch method in designed level.

(*h*) What is use of deployment diagrams ?

(*i*) Define Test Case.

(*j*) What is meant by Alpha testing ?

2. Attempt any *two* of the following : [5×2=10]

(*a*) Explain any *five* artifacts and issues considered during Inceptions.

(*b*) What do you mean by Relationship ? Explain different kinds of relationships.

(*c*) Draw Activity diagram for customer process in online buying of toys.

3. Attempt any *two* of the following : [5×2=10]

(*a*) Write a note on Jacobson method.

(*b*) Prepare a class diagram for "Online Gas Booking System" consisting of at least three classes. Define appropriate relationship association with multiplicity.

(*c*) Write a note on object oriented testing strategy.

4. Attempt the following : [10]

(*a*) An automated system is to be designed for ATM banking. A bank can have multiple customers and all of them are issued the ATM cards. Customer swap the card which is verified by an ATM. Customer select the kind of a transaction. If the transaction is to withdraw amount, it verifies the limit and minimum balance required. It also prints various transaction reports, account balance statement etc.

Considering above aspects draw the following diagrams :

(*i*) Draw use case diagram. [3]

(*ii*) Draw sequence diagram. [4]

(*b*) Draw state transition diagram for stack operations. [3]

Or

Explain structural aspects of a collaboration. [3]

Total No. of Questions—**5**] [Total No. of Printed Pages—**5**

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F.Y. B.Sc. (Computer Science) EXAMINATION, 2018

MATHEMATICS

Paper II

(MTC-102 : Algebra and Calculus)

(2013 PATTERN)

Time : Three Hours **Maximum Marks : 80**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Use of non-programmable scientific calculator is allowed.

1. Attempt any *eight* of the following : [16]

(*i*) Let X = {*a*, *b*, *c*, *d*} be a set. Give *one* example of a relation R on X which is only transitive but neither reflexive nor symmetric.

(*ii*) List the ordered pairs in relation ρ on the set {1, 2, 3} corresponding to the matrix M(ρ). Hence draw the directed graph from M(ρ).

$$M(\rho) = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}.$$

(*iii*) Let $f(x)$ be a real-valued function given by $f(x) = x^2 + 1$. Is $f(x)$ one-one function ? Justify.

P.T.O.

(*iv*) Prove that integers 361 and 420 are co-primes (Relatively prime).

(*v*) Write the addition table for $(Z_5, +_5)$.

(*vi*) Find the 50th derivative of $y = a^{mx}$.

(*vii*) Let permutation $\sigma = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 2 & 6 & 1 & 3 & 4 & 5 \end{pmatrix}$. Is this permutation even or odd ?

(*viii*) Prove that :

$$19 \mid (2^{18} - 1).$$

(*ix*) State Taylor's theorem for Cauchy's form of remainder.

(*x*) Determine value of '*a*' for which the following system of equations has infinitely many solutions :

$$(a - 3)x + y = 0$$
$$x + (a - 3)y = 0.$$

2. Attempt any *four* of the following : [16]

(*i*) Using principle of Mathematical induction, prove that $2^n < n!$ $\forall\, n \geq 4, n \in \mathbf{Z}$.

(*ii*) Draw the composition table for the set G = {1, –1, *i*, –*i*} under multiplication. Find all the generators for the above group.

(*iii*) Let $f, g : Z \to Z$ be two functions such that, $f(x) = 2x - a$ and $g(x) = bx + 1$. Determine, if, $f \circ g = g \circ f$, then :

$$ab - a + 1 = 0.$$

(*iv*) If $a \equiv b \pmod{n}$, then prove that :

(a) $a + x \equiv b + x \pmod{n}$

(b) $a \cdot x \equiv b \cdot x \pmod{n}$.

(*v*) Consider the following permutations :

$$\tau = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 4 & 5 & 6 & 1 & 2 \end{pmatrix}; \quad \rho = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 2 & 4 & 3 & 1 & 6 & 5 \end{pmatrix}.$$

Find :

(1) $\tau \cdot p^{-1}$

(2) $\tau^{-1} \cdot p^2$

(*vi*) Find the remainder of 333^{111} when divided by 7.

3. Attempt any *two* of the following : [16]

(*i*) Find GCD (Greatest Common Divisor) d of 6162 and 1213. Hence find integers m and n such that :

$$d = 6162m + 1213n.$$

(*ii*) Let A = {1, 2, 3, 4} and R = {(1, 2), (2, 3), (3, 4), (2, 1)} be a relation defined on A. Using Warshall's algorithm, find the transitive closure of R. Also, draw the diagraph for M(R*).

(*iii*) Let G = Q – {–1} where Q = set of rational numbers. Define binary operation * on G by :

$$a * b = a + b + ab, \ \forall \ a, b \in G.$$

(a) Prove that (G, *) is a monoid.

(b) For any $x \in G$, does the inverse of x, i.e. x^{-1} exist in G ? Find the inverse of x. Justify your answer.

4. Attempt any *four* of the following : [16]

(*i*) For what values of k is the function :

$$f(x) = x, \quad x < -2$$

$$= k \cdot x^2, \quad x \geq -2$$

continuous everywhere ?

(*ii*) Expand $f(x) = \log(1 - x)$ in ascending powers of x.

(*iii*) Convert the following matrix A into Row Reduced Echelon form. Hence determine the row rank of matrix A :

$$A = \begin{bmatrix} 0 & 1 & 2 & 1 \\ 0 & -1 & 0 & 2 \\ 1 & 2 & 1 & 1 \end{bmatrix}.$$

(*iv*) Verify Rolle's theorem for $f(x) = 2x^3 + x^2 - 4x - 2$ in the interval $[-\sqrt{2}, \sqrt{2}]$.

(*v*) If $y = \dfrac{1}{x^2 - x - 2}$, find the nth derivative y_n.

(*vi*) Consider matrix $M = \begin{bmatrix} 3 & -6 & -3 \\ 2 & 0 & 6 \\ -4 & 7 & 4 \end{bmatrix}$. Use LU decomposition method to express M as L.U.

5. Attempt any *two* of the following : [16]

(*i*) State Taylor's theorem. Use Taylor's series to expand $f(x) = e^x \cdot \cos x$ in ascending powers of $\left(x - \dfrac{\pi}{4}\right)$.

(*ii*) Solve the following system of equations by Gauss Jordan elimination process :

$$3x_1 + 2x_2 - x_3 = -15$$
$$5x_1 + 3x_2 + 2x_3 = 0$$
$$3x_1 + x_2 + 3x_3 = 11$$
$$-6x_1 - 4x_2 + 2x_3 = 30.$$

(*iii*) If $y = (\sin^{-1} x)^2$, then prove that :

(*a*) $(1 - x^2)y_2 - xy_1 - 2 = 0$

(*b*) $(1 - x^2)y_{n+2} - (2n + 1)\, x \,.\, y_{n+1} - n^2 y_n = 0.$

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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[5423]-401

T.Y. B.Sc. (C.S.) (Third Semester) EXAMINATION, 2018

COMPUTER SCIENCE

(CS-341 : System Programming and Operating System-II)

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) Neat diagrams must be drawn wherever necessary.

(*ii*) Figures to the right indicate full marks.

(*iii*) *All* questions carry equal marks.

1. Attempt *All* of the following : [10×1=10]

(*a*) What is kernel ?

(*b*) What are the types of processes ?

(*c*) Define turn around time.

(*d*) State the necessary conditions for a deadlock to occur.

(*e*) Define cache memory.

(*f*) What is bit vector ?

(*g*) What do you understand by a thread ?

(*h*) What are the types of semaphores ?

P.T.O.

(*i*) Define multiprocessor system.

(*j*) List any *two* advantages of multithreaded programming.

2. Attempt any *two* of the following : [2×5=10]

(*a*) Write a short note on process states.

(*b*) Consider the following set of processes with length of CPU burst time and arrival time given in milliseconds :

Process	**Burst Time**	**Arrival Time**
P1	5	1
P2	6	0
P3	2	1
P4	4	0

Illustrate the execution of these processes using round robin scheduling algorithms. Also calculate wait time, turn around time of each process and calculate average waiting time and average turn around time for above situation. Also draw Gantt Chart. Consider the time quantum 3.

(*c*) Explain critical selection problem.

3. Attempt any *two* of the following : [5×2=10]

(*a*) Explain the different ways for deadlock recovery.

(*b*) Write a note on segmentation hardware.

(*c*) Explain the indexed allocation and linked allocation method of disk space management.

4. Attempt any *one* (A *or* B) : [1×10=10]

(A) (*i*) Explain the process of CPU-I/O burst cycle with neat diagram. [4]

(*ii*) Assume a system has 3 processes and 4 resources with 1, 2, 1, 4 instances of each resource respectively :

Process P0 holds 1 instance of R1

Process P1 holds 1 instance of R0 and R1

Process P1 requests for 1 instance of R2

Process P2 holds 1 instance of R1

Check if deadlock is present. [4]

(*iii*) List any *four* attributes of file. [2]

Or

(B) (*i*) Discuss the bounded buffer problem with its solution. [4]

(*ii*) Let the reference string is :

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

Use LRU algorithm to find the number of page faults :

(1) when there are 3 frames.

(2) when there are 4 frames. [4]

(*iii*) What is page table ? What are its contents ? [2]

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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[5423]-402

T.Y. B.Sc. (CS) (Fourth Semester) EXAMINATION, 2018

CS-342 : COMPILER CONSTRUCTION

Paper II

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions carry equal marks.

(*ii*) *All* questions are compulsory.

(*iii*) Figures to the right indicate full marks.

(*iv*) Neat diagrams must be drawn wherever necessary.

1. Attempt all of the following : [10×1=10]

(*a*) What is the output of LEX program ?

(*b*) List the phases of compiler.

(*c*) Which parser is most powerful parser in Bottom up parser ?

(*d*) What is the purpose of augmenting the grammar ?

(*e*) Define the term token.

(*f*) State True or False. An SDD is S-attributed if every attribute is synthesized.

(*g*) State any *two* functions of Lex library.

P.T.O.

(*h*) Define the term bootstrapping.

(*i*) Name the conflict which is not possible in LR parser.

(*j*) What is handle pruning ?

2. Attempt any *two* of the following : [2×5=10]

(*a*) Check whether the given grammar is LL(1) or not :

$S \rightarrow aAB \mid$

$A \rightarrow Aa \mid b$

$B \rightarrow bB \mid \in$

(*b*) Define Directed Acyclic Graph (DAG). Construct DAG for the following expressions :

1. (1 + 1*(3–2) + (3–2)*4)

2. r + s * t + (s * t)/u

(*c*) Write a LEX Program for calculating the cube of a given number.

3. Attempt any *two* of the following : [2×5=10]

(*a*) What is an operator grammar ? Consider the following grammar :

$S \rightarrow (T) \mid a \mid \wedge$

$T \rightarrow T, S$

Compute LEADING and TRAILING symbols.

(*b*) Consider the following grammar and parse the input string "abbb#" using shift-reduce parser. Show the contents of stack, input and action taken at each stage :

$S \rightarrow R\#$

$R \rightarrow P \mid Rb \mid b$

$P \rightarrow a$

(*c*) State any *four* differences between Static and Dynamic Memory Allocation.

4. Attempt any *one* (either A *or* B) of the following :

(A) (*i*) Check whether the given grammar is LR (1) or not : [6]

$S \rightarrow Aa \mid bAc$

$A \rightarrow d.$

(*ii*) Write a Recursive Descent Parser (RDP) for the following grammar : [4]

$S \rightarrow aA \mid bB$

$A \rightarrow aA \mid b$

$B \rightarrow dB \mid b$

Or

(B) (*i*) Check whether the given grammar is SLR (1) or not : [6]

$E \rightarrow E + T \mid T$

$T \rightarrow T * F \mid F$

$F \rightarrow a.$

(*ii*) Write a short not on SDD (Syntax Directed Definitions). [4]

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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[5423]-403

T.Y. B.Sc. (Fourth Semester) EXAMINATION, 2018

COMPUTER SCIENCE

Paper III

(CS-343 : Computer Network-II)

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

1. Attempt *All* : [10×1=10]

(*a*) Define routing.

(*b*) What are the types of the HTTP services ?

(*c*) What is fragmentation ?

(*d*) State the minimum and maximum Ethernet frame length.

(*e*) How many maximum no. of computers are used to create Piconet ?

(*f*) State true or false—ARP replay is unicast.

P.T.O.

(*g*) List the protocols used at transport layer.

(*h*) What is congestion ?

(*i*) What are the different data structure supported by FTP ?

(*j*) List the services provided by TCP.

2. Attempt any *two* : [2×5=10]

(*a*) By using transposition cipher convert the following plain text to cipher text. Using key **ZQPBEXC.**

"Digital signature is a mathematical method for implementing the authentication of a digital message or document".

(*b*) What are the services provided by the network layer ?

(*c*) Give difference between TCP and UDP.

3. Attempt any *two* : [2×5=10]

(*a*) What is ARP ? Explain its working.

(*b*) Explain the types of traditional Ethernet.

(*c*) What is address resolution ? Explain recursive and iterative resolution in DNS.

4. Attempt A *or* B : [1×10=10]

(A) (*i*) Explain the datagram circuit and virtual circuit in detail. [4]

(*ii*) What are the network security principles ? [4]

(*iii*) Explain Adaptive and Non-adaptive routing algorithm. [2]

Or

(B) (*i*) Explain BSS and its types with diagrams. [4]

(*ii*) Explain multiplexing and demultiplexing in transport layer. [4]

(*iii*) List the congestion control policies used at network layer. [2]

Total No. of Questions—**4**] [Total No. of Printed Pages—**2**

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T.Y. B.Sc. (IV Semester) EXAMINATION, 2018
COMPUTER SCIENCE
Paper-IV
(CS-344 : Internet Programming-II)
(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.
(*ii*) *All* questions carry equal marks.
(*iii*) Figures to the right indicate full marks.

1. Attempt *all* of the following : [10×1=10]
(*a*) "Http is stateless protocol." Comment.
(*b*) Write any *two* applications of XML.
(*c*) What is the use of iSNAN ( ) function in Java Script ?
(*d*) "POP3 Protocol is used to receive the email." True/False. Justify.
(*e*) What is the use of die( ) function ?
(*f*) Define XML Parser.
(*g*) Define Cookie.
(*h*) What is the need of XML Http request object in Ajax ?
(*i*) What is the use of checkdnsr( ) function ?
(*j*) Write syntax of mail( ) function.

2. Attempt any *two* of the following : [2×5=10]
(*a*) Explain $_FILE array with suitable example.
(*b*) Write any *five* advantages of XML over HTML.
(*c*) Discuss *three* kinds of pop up boxes in Java Script.

3. Attempt any *two* of the following : [2×5=10]
(*a*) Write a PHP script to accept two strings from the user and check if two strings are equal or not using Stickey forms.

P.T.O.

(*b*) Write a PHP script to read account .XML which contains Account No, Name, Address, Branch, Account Type, Balance. Print account details of specific branch in tabular format after accepting branch as input.

(*c*) Write Java script code to display clock in Text box (on load event).

4. Attempt any *one* of the following (A *or* B) :

(A) (*a*) Write a PHP script to accept student details CSno, Name, Class on first page. On second page accept marks of 6 subjects. On third page print the student details (Sno, name, class, marks) with total and percentage. [4]

(*b*) Which are the areas where Java Script is placed in the browser ? Explain in detail. [4]

(*c*) Write a short note on SSL. [2]

Or

(B) (*a*) Design the HTML form to accept customer name, age and mobile no. and perform the following validation using Java Script : [4]

(1) Field should not be empty.

(2) Mobile no. must contain 10 digits.

(*b*) Explain the features of Http protocol. [4]

(*c*) Explain any *two* window object methods in Java Script. [2]

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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T.Y. B.Sc. (C.S.) (Fourth Semester) EXAMINATION, 2018

COMPUTER SCIENCE

Paper V

(CS-345 : Programming in Java II)

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) *All* questions carry equal marks.

(*iii*) Figures to the right indicate full marks.

1. Attempt *All* of the following : [10×1=10]

(*a*) What is collection framework ?

(*b*) What are the methods used in Vector class ?

(*c*) Write ony *two* methods of HTTP session.

(*d*) State the advantage of using type 3 JDBC driver.

(*e*) Explain the session tracking.

(*f*) What is scriplet ?

(*g*) Which class is used to get IP-address of machine ?

P.T.O.

(*h*) "Multithreading is better than multiprocessing". Comment.

(*i*) Define the term Socket.

(*j*) State any *two* methods for inter-thread communication.

2. Attempt any *two* : [5×2=10]

(*a*) Write a servlet program to get information about the server such as name, server port number and server version.

(*b*) Write JSP program to demonstrate all three scripting tags used in JSP.

(*c*) Explain JDBC Architecture with types of JDBC drivers.

3. Attempt any *two* : [5×2=10]

(*a*) Write JSP program to accept student name, address and class from HTML and display it on another page.

(*b*) The project in a database has the following fields :

Title (text), student Name (text), duration (Number), Class(text), submissiondate (date).

Write a Java program to read the project details from user and add it in table. Continue the process until user press 'Y' to the prompt. Add more (Yes/No) ?

(*c*) What is a servlet ? Differentiate doGet( ) and doPost( ) methods.

4. Attempt any *one* (either A *or* B) of the following :

(A) (*i*) Explain life cycle of thread. [4]

(*ii*) Write a servlet program to count number of times a servlet has been invoked. [4]

(*iii*) Write a note on TreeMap class. [2]

Or

(B) (*i*) Explain the Server Socket class and Datagram Socket class in Java. Also state the methods of both classes. [4]

(*ii*) What is JSP ? Explain JSP life cycle. [4]

(*iii*) Write a code using Hashtable, that will maintain the names and phone nos of two students. [2]

Total No. of Questions—**4**] [Total No. of Printed Pages—**3**

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T.Y. B.Sc. (Computer Science) (Fourth Semester)

EXAMINATION, 2018

CS-346 : COMPUTER GRAPHICS

Paper VI

(2013 PATTERN)

Time : Two Hours **Maximum Marks : 40**

N.B. **:—** (*i*) Figures to the right indicate full marks.

(*ii*) Draw neat diagrams whenever necessary.

(*iii*) *All* questions are compulsory.

(*iv*) Use of calculator is allowed.

1. Attempt *All* of the following : [10×1=10]

(*a*) Define Resolution.

(*b*) What is data glove ?

(*c*) State any *two* Hard copy devices.

(*d*) What is scan conversion ?

(*e*) Define Homogeneous co-ordinates.

(*f*) State applications of clipping.

P.T.O.

(*g*) What is centre of projection ?

(*h*) State the disadvantages of A-buffer algorithm.

(*i*) What is meant by locator ?

(*j*) Define view port.

2. Attempt any *two* : [5×2=10]

(*a*) Generate points only for one octant of circle with centre (2,3) and radius 10 using mid-point circle generation algorithm.

(*b*) Calculate final co-ordinates for point (2,3,4) after the following 3-D transformation. (Use matrix representation) :

(*i*) Rotate with angle 90° along x-axis.

(*ii*) Reflect along xy-plane.

(*c*) Calculate final co-ordinate of an object A(0, 0) B(1, 0), C(1, 1), D(0, 1) rotated by 45° about origin.

3. Attempt any *two* : [5×2=10]

(*a*) Give the difference between rasters versus vector.

(*b*) Explain viewing pipeline in detail.

(*c*) Write the four connected boundary fill algorithm.

4. Attempt any *one* (A *or* B) : [4+4+2=10]

(A) (*i*) What are choice type devices ? Give any *two* examples. [4]

(*ii*) Explain BSP tree algorithm for hidden surface elimination. [4]

(*iii*) State any *four* input devices. [2]

Or

(B) (*i*) What is parallel projection in 3-D ? [4]

(*ii*) Explain 2-D transformation on parallel lines. [4]

(*iii*) State any *two* GUI components in open GL along with their methods. [2]

Total No. of Questions—**5**] [Total No. of Printed Pages—**5**

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[5423]-5

F.Y. B.Sc. (Computer Science) EXAMINATION, 2018

ELECTRONIC SCIENCE

Paper I

(ELC-101 : Principles of Analog Electronics)

(2013 PATTERN)

Time : Three Hours **Maximum Marks : 80**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Neat diagrams must be drawn wherever necessary.

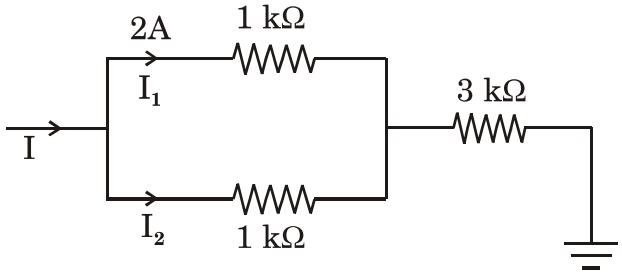
(*iii*) Figures to the right indicate full marks.

1. Attempt all of the following : [8×2=16]

(*a*) Draw symbols for air core and ferrite core inductor.

(*b*) Distinguish between half wave and full wave rectifier.

(*c*) Find current through 3 kΩ resistor.



(*d*) Define the terms gain and bandwidth of an amplifier.

(*e*) State maximum power transfer theorem and superposition theorem.

P.T.O.

(*f*) For a transistor, collector current changes from 10 mA to 20 mA when base current changes from 5 μA to 25 μA. Find α and β of transistor.

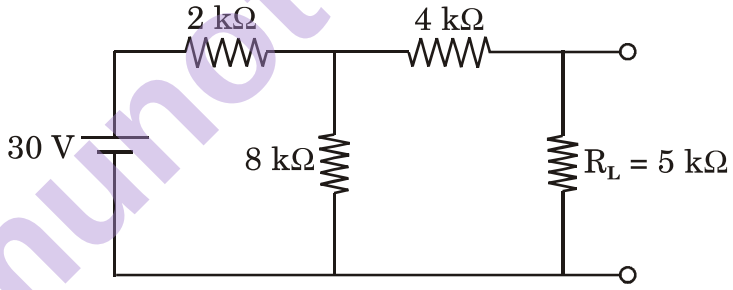
(*g*) Derive relation between drain resistance (r_d), transconductance (g_d) and amplification factor (μ) for JFET.

(*h*) Draw circuit diagram for unity gain amplification using Op-Amp.

2. Attempt any *four* of the following : [4×4=16]

(*a*) Explain colour code system for resistors.

(*b*) Find the Thevenin's equivalent circuit for the following circuit :



(*c*) With a neat circuit diagram explain bridge rectifier.

(*d*) Draw circuit diagram for RC-coupled single stage common emitter amplifier and explain its working.

(*e*) Explain working of UJT with a neat diagram.

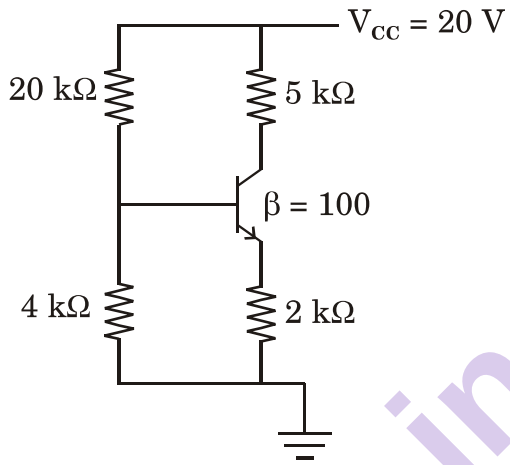
(*f*) Draw the circuit diagram of Op-Amp as subtractor and derive the expression for its output voltage.

3. Attempt any *four* of the following : [4×4=16]

(*a*) Explain concept of virtual ground in Op-Amp.

(*b*) Explain JFET as a voltage variable resistor.

(*c*) Draw DC load line for the following circuit and locate Q point. Assume the transistor to be of silicon :



(*d*) Explain working of shunt clipper.

(*e*) Draw the circuit diagram of RC low pass filter and explain its working.

(*f*) Explain working of step-down transformer.

4. Attempt any *four* of the following : [4×4=16]

(*a*) Distinguish between BJT and JFET.

(*b*) Explain construction and working of *n*-channel DMOSFET.

(*c*) Define the following parameters related to Op-Amp :

(*i*) CMRR

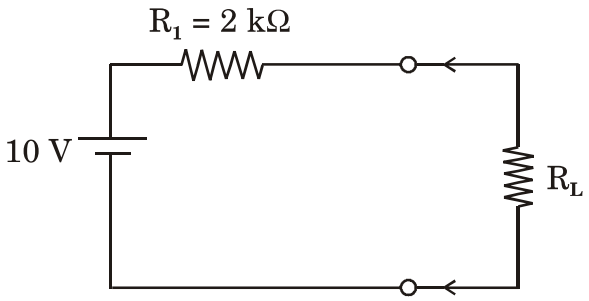
(*ii*) Input bias current

(*iii*) Slew rate

(*iv*) Output offset voltage.

(*d*) Define fuse. What is the need of fuse ? Explain cartridge fuse.

(*e*) Verify the maximum power theorem for load resistance 1 kΩ, 2 kΩ, 3 kΩ for the following circuit :

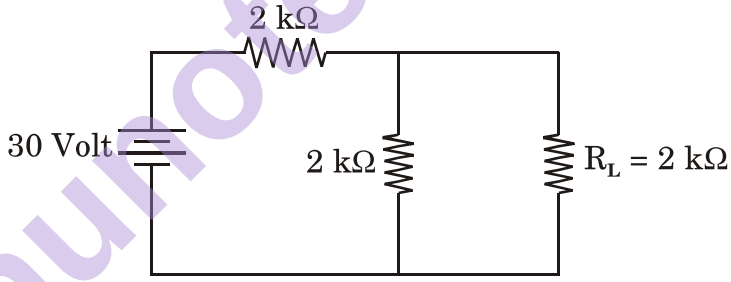


(*f*) Explain working principle of LED.

5. Attempt any *two* of the following : [2×8=16]

(*a*) (*i*) Explain construction and working of co-axial cable.

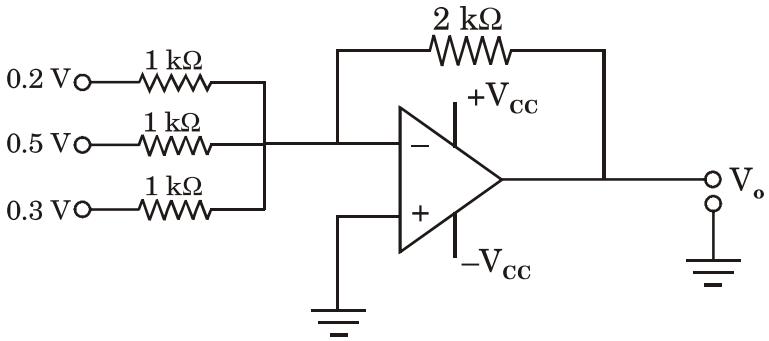
(*ii*) State Norton's theorem. Hence find the current through load resistance R_L :



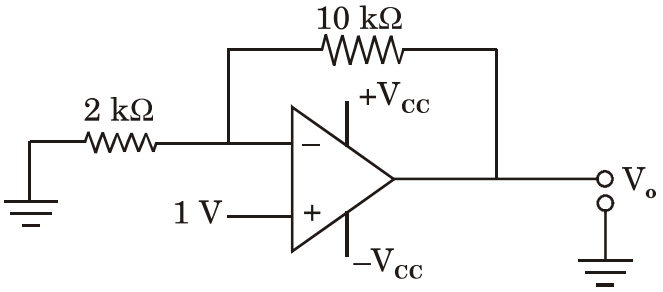
(*b*) (*i*) Explain classification of amplifiers on the basis of α-pt selection.

(*ii*) Identify the following circuit and find output :

(1)



(2)



(*c*) (*i*) Explain LCR series resonance circuit.

(*ii*) Compare CB, CE and CC configuration on the basis of parameters current gain, voltage gain, input resistance and output resistance.

Total No. of Questions—**5**] [Total No. of Printed Pages—**4**

Seat No.	

[5423]-6

F.Y. B.Sc. (Computer Science) EXAMINATION, 2018

ELECTRONIC SCIENCE

Paper II

(ELC-102 : Principles of Digital Electronics)

(2013 PATTERN)

Time : Three Hours **Maximum Marks : 80**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

1. Attempt all of the following : [8×2=16]

(*a*) Convert $(10111101)_2$ to Gray code.

(*b*) Simplify the expression :

$$Y = (A + \bar{A})(AC + ABC).$$

(*c*) Draw the logic diagram for half subtractor.

(*d*) For a multiplexer having 42 inputs find the number of control lines required.

P.T.O.

(*e*) Mention the different ways to eliminate race around condition in JK flip-flops.

(*f*) Draw the symbol of a tristate inverter and give its truth table.

(*g*) Differentiate between encoder and decoder.

(*h*) Find the number of clock pulses required for four bit parallel loading and shifting of data in a register.

2. Attempt any *four* of the following : [4×4=16]

(*a*) Perform :

(*i*) $(207)_{10} = (?)_2$

(*ii*) $(FAD)_{16} = (?)_{10}$.

(*b*) Convert the given expression into standard POS form :

$$Y = (A + \overline{B})(A + \overline{C}).$$

(*c*) With neat logic diagram explain the working of a full adder.

(*d*) Explain the working of a 1 : 4 demultiplexer using AND gates.

(*e*) With neat logic diagram explain the working of a JK flip-flop.

(*f*) With suitable diagram explain the concept of Wired-OR operation.

3. Attempt any *four* of the following : [4×4=16]

(*a*) Draw the symbol and give the truth table for :

(*i*) 2 input OR gate

(*ii*) 2 input XNOR gate.

(*b*) Construct AND gate using only NOR and only NAND gates.

(*c*) With neat diagram explain the working of four bit parallel adder.

(*d*) Draw the logic diagram and give the truth table for BCD to decimal conversion.

(*e*) Show the connections of IC 7490 for MOD7 and MOD8 operation.

(*f*) Define the following parameters for a logic gate :

Power dissipation, noise immunity, logic levels and propagation delay.

4. Attempt any *four* of the following : [4×4=16]

(*a*) Explain the working of two input AND gate using discrete components.

(*b*) Simplify the given expression using K map. Draw the simplified diagram :

$$Y = \bar{A}\bar{B}C + \bar{A}\bar{B}\bar{C} + AB\bar{C} + \bar{A}BC + \bar{A}B\bar{C}.$$

(*c*) Explain with block diagram the working of ALU.

(*d*) Draw the block diagram of a BCD to 7 segment converter. For the BCD inputs 8 and 3, what will be the seven segment outputs ? Assume common cathode seven segment display type is used.

(*e*) With neat logic diagram explain the working of a 3-bit serial in serial out left shift register.

(*f*) Write a short note on logic families.

5. Attempt any *two* of the following : [2×8=16]

(*a*) (*i*) Explain the working of a 3-bit parity generator with suitable diagram.

(*ii*) Perform $(35)_{10}$ — $(62)_{10}$ using two's complement method.

(*b*) With neat diagram explain the working of 3-bit asynchronous down counter. Draw the timing diagram for the same.

(*c*) (*i*) Explain the working of a 3×4 matrix keyboard encoder with suitable block diagram.

(*ii*) State and prove the De Morgan's theorems.

Total No. of Questions—**5**] [Total No. of Printed Pages—**8**

Seat No.	

[5423]-7

F.Y. B.Sc. (Computer Science) EXAMINATION, 2018

STATISTICS

Paper I

(Statistical Methods—I)

(2013 PATTERN)

Time : Three Hours **Maximum Marks : 80**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) Use of non-programmable, scientific calculator and statistical tables is allowed.

(*iv*) Symbols have their usual meaning unless otherwise stated.

1. (A) Fill in the blanks : [1 mark each]

(*i*) The coefficient of skewness based upon quartiles is given by ..... .

(*ii*) In time series, the component having period of oscillation more than one year is called as ..... .

(*iii*) The mean of binomial distribution is ..... .

(*iv*) If b_{yx} = 0.5 and b_{xy} = 0.5, then r = ...

P.T.O.

(B) Select the most appropriate option for each of the following : [1 mark each]

(*i*) In formula for correlation coefficient, r, for bivariate data, the numerator represents :

(*a*) variance of X

(*b*) variance of Y

(*c*) 1

(*d*) covariance between X and Y

(*ii*) The platykurtic distribution is one in which :

(*a*) $\beta_2 > 3$

(*b*) $\beta_1 > 3$

(*c*) $\beta_2 < 3$

(*d*) $\beta_2 = 3$

(*iii*) Which of the following indicates the strongest relationship ?

(*a*) $r = 0.5$

(*b*) $r = 0.09$

(*c*) $r = -0.7$

(*d*) $r = 0.2$

(*iv*) Which central moment indicates whether distribution is symmetrical or not ?

(*a*) First moment

(*b*) Third moment

(*c*) Second moment

(*d*) Fourth moment

(C) Attempt each of the following : [2 marks each]

(*i*) State AR(1) model of time series.

(*ii*) If X follows discrete Uniform distribution with $n = 10$, find the standard deviation of X.

(*iii*) State additive property of the Poisson distribution.

(*iv*) A random variable takes values 1, 2, 3 with probabilities 1/4, 1/2, 1/4 respectively. Find probability mass function of $Y = (2X - 1)$.

2. Attempt any *four* of the following : [4 marks each]

(*a*) Describe the procedure to plot histogram for a grouped frequency distribution.

(*b*) The first quartile of the following data is 21.5 :

Number of lectures attended by a student	**Number of Students**
10—15	24
15—20	—
20—25	90
25—30	122
30—35	—
35—40	56
40—45	20
45—50	33

Find the values of the missing frequencies.

(*c*) Explain stem and leaf chart with the help of an example.

(*d*) Consider the following data on strike rate of two batsmen A and B in 10 one-day matches :

	Batsman A	**Batsman B**
Mean Strike Rate	67	81
Variance of Strike Rate	15	17

(*i*) Which batsman has less average strike rate ? Justify your answer.

(*ii*) Which batsman is more consistent in strike rate ? Justify your answer.

(*e*) Define each of the following :

(*i*) Inclusive class interval

(*ii*) Class mark

(*iii*) Class width

(*iv*) Frequency of a class.

(*f*) Consider the following data :

Distance (kms) travelled by a car per liter of petrol	**Number of Cars**
8—11	12
11—14	17
14—17	22
17—20	16
20—23	13

Draw less than ogive curve and locate median from it.

3. Attempt any *four* of the following : [4 marks each]

(*a*) Discuss merits and demerits of mean as a measure of central tendency.

(*b*) The variance of a distribution is 14. What should be the value of fourth central moment so that distribution will be (*i*) mesokurtic (*ii*) leptokurtic ?

(*c*) Define *r*th raw and central moments for a raw data. Also, express 3rd central moment in terms of raw moments.

(*d*) Comment upon skewness using appropriate coefficient of skewness for each of the following :

(*i*) $Q_1 = 20$, $Q_2 = 25$, $Q_3 = 30$

(*ii*) mean = 50, mode = 48, $\sigma = 20$.

(*e*) What is Bernoulli experiment ? Discuss how a Bernoulli experiment leads to a binomial experiment. Also, state p.m.f. of binomial distribution.

(*f*) The probability distribution of X is as follows :

x_i	$P(X = x_i)$
10	$k + 0.02$
11	$k + 0.05$
12	$5k - 0.02$
13	$7k + 0.03$
14	$2k + 0.02$
15	$2k$

(*i*) Find the value of k.

(*ii*) Find $P[(12 \leq X \leq 14)/(X \geq 13)]$.

4. Attempt any *two* of the following : [8 marks each]

(A) (*i*) What is correlation ? Illustrate your answer with the help of an example. Show perfect positive correlation on a scatter diagram.

(*ii*) Consider the following calculations for a bivariate data : $n = 10$, $\Sigma x = 130$, $\Sigma y = 220$, $\Sigma x^2 = 2288$, $\Sigma y^2 = 5506$, $\Sigma xy = 3467$.

Find the equation of line of regression of Y on X. Also, estimate value of Y when X = 16.

(B) (*i*) Write a short note on Box plot.

(*ii*) The probability that a secretary will not put the correct postage on an envelope is 0.2. If he puts postage on 9 envelopes, find the probability that the postage will not be correct on 3 envelopes. Also find the probability that at most 3 envelopes will not have correct postage.

(C) (*i*) Define Cumulative Distribution Function (CDF) for a discrete random variable. State at least *three* properties of CDF.

(*ii*) A sweet mart has the following schedule of daily demand for sweet boxes. X is number of sweet boxes demanded per day :

x_i	p_i
0	0.09
1	0.1
2	0.11
3	0.2
4	0.2
5	0.18
6	0.12

Find the values of mean, median and mode of X.

(D) (*i*) 5% of the onion bags brought by a farmer in the market have less than expected weight. The bags are inspected for their weight one by one. Find the probability that 8th onion bag is the first one to have less than expected weight. Also, find mean of the distribution.

(*ii*) For a trivariate data, $r_{12} = 0.75$, $r_{13} = 0.43$, $r_{23} = 0.54$. Find the values of $R_{2.13}$ and $r_{23.1}$.

5. Attempt any *one* of the following : [16 marks]

(A) (*i*) Describe procedure for fitting equation $Y = a + bX + cX^2$ for a bivariate data by method of least squares.

(*ii*) Consider the following data on three economic indicators (X_1, X_2 and X_3) found in a survey made for 5 years :

$\bar{X}_1 = 19.1$ $\bar{X}_2 = 2.78$ $\bar{X}_3 = 3.4$

$\sigma_1 = 0.992$ $\sigma_2 = 3.31$ $\sigma_3 = 0.8$

$r_{12} = -0.15$ $r_{13} = -0.57$ $r_{23} = 0.37$

(1) Find the equation of plane of regression of X_2 on X_1 and X_3.

(2) Estimate X_2 when $X_1 = 19$ and $X_3 = 5$.

(B) (*i*) For a bivariate data, two lines of regression are $2X + 3Y = 6$ and $5X + 7Y = 12$ and variance of X is 10. Find :

(1) Means of X and Y.

(2) Coefficient of correlation between X and Y.

(3) Variance of Y.

(*ii*) Consider the following data on inventory ('000 Rs.) for the years 1991 to 2000. Estimate trend values using method of moving averages with $m = 4$:

Year	**Inventory (Y)**
1991	4620
1992	4910
1993	5490
1994	5730
1995	5400
1996	5600
1997	5850
1998	5990
1999	6010
2000	6120

Total No. of Questions—**5**] [Total No. of Printed Pages—**8**

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F.Y. B.Sc. (Computer Science) EXAMINATION, 2018

STATISTICS

Paper II

(Statistical Methods—II)

(2013 PATTERN)

Time : Three Hours **Maximum Marks : 80**

N.B. **:—** (*i*) *All* questions are compulsory.

(*ii*) Figures to the right indicate full marks.

(*iii*) Use of non-programmable, scientific calculator and statistical tables is allowed.

(*iv*) Symbols have their usual meaning unless otherwise stated.

1. (A) Fill in the blanks : [1 mark each]

(*i*) An event A which contains no element of sample space is called as .....

(*ii*) If two events A and B are mutually exclusive then $P(A \cup B)$ = ...

(*iii*) If random variable X follows exponential distribution with mean θ, then its variance is given by .....

(*iv*) A hypothesis of "no difference" is called as .....

P.T.O.

(B) Select the most appropriate option for each of the following : [1 mark each]

(*i*) Given three arbitrary events A, B and C defined on Ω, then the expression for the event "Simultaneous occurrence of all events" is :

(*a*) $A \cup B \cup C$

(*b*) $A \cap (B \cup C)$

(*c*) $A \cap B \cap C$

(*d*) $A \cup (B \cap C)$

(*ii*) Let A and B be two events such that P(A) = 0.4, P(B) = 0.3, $P(A \cap B) = 0.2$, then $P(A \cap B') =$

(*a*) 0.1

(*b*) 0.2

(*c*) 0.5

(*d*) 0.6

(*iii*) If X is a continuous random variable then var(5 – 3X) is :

(*a*) –3 var(X)

(*b*) 9 var(X)

(*c*) 2 var(X)

(*d*) var(5) –3 var(X)

(*iv*) The nature of critical region depends upon :

(*a*) Degree of freedom

(*b*) Level of significance

(*c*) Type of null hypothesis

(*d*) Type of alternative hypothesis

(C) Attempt each of the following : [4×2=8]

(*i*) A continuous random variable X has the probability density function (p.d.f.) :

$$f(x) = 5x^4, \quad 0 \leq X \leq 1$$
$$= 0, \quad \text{otherwise}$$

Find E(X).

(*ii*) State lack of memory property of exponential distribution.

(*iii*) What is simulation ?

(*iv*) State axiomatic definition of probability.

Group I

2. Attempt any *four* of the following : [4 marks each]

(A) A student is to answer 8 out of 10 questions in an examination :

(*i*) How many choices has he ?

(*ii*) How many choices has he if he must answer the first 3 questions ?

(B) Define each of the following with an illustration :

(*i*) Finite sample space

(*ii*) Exhaustive events.

(C) Of 10 research students, 3 have knowledge of Python software. If two of the research students are chosen at random, find the probability that :

(*i*) both have knowledge of Python software.

(*ii*) at least one has knowledge of Python software.

(D) Five books of Computers and two books of Mathematics are arranged on a shelf. Find the probability that two books of Mathematics are :

(*i*) not side by side

(*ii*) always together.

(E) Give classical definition of probability. State its limitations.

(F) (*i*) Prove that "If A' is the complement of A with respect to Ω then $P(A) + P(A') = 1$".

(*ii*) Given $P(A) = 0.35$, $P(B) = 0.65$ and $P(A \cap B) = 0.12$, find : $P(A \cup B)$ and $P(A' \cap B')$.

3. Attempt any *four* of the following : [4 marks each]

(A) (*i*) Define conditional probability.

(*ii*) If the probability that a communication system will have high fidelity is 0.81 and the probability that it will have high fidelity and high selectivity is 0.18. Find the probability that a system will have high selectivity given that it has high fidelity.

(B) Define each of the following with *one* illustration each :

(*i*) Non-deterministic experiment

(*ii*) Independence of two-events.

(C) A consulting firm rents cars from three agencies, 20% from agency D, 20% from agency E and 60% from agency F. If 10% of the cars from D, 12% of the cars from E and 4% of the cars from F have bad tyres. What is the probability that a car with bad tyres rented by the firm came from agency F ?

(D) Define each of the following :

(*i*) Continuous random variable

(*ii*) Distribution function of a continuous r.v. X.

(E) The length of satisfactory service (years) provided by a certain model of laptop computer is a random variable (r.v.) X having the p.d.f. :

$$f(x) = \begin{cases} \frac{1}{4.5} e^{-x/4.5}, & \text{for } x > 0 \\ 0, & \text{otherwise} \end{cases}$$

Find the probability that one of these laptops will provide satisfactory service for :

(*i*) at least 6.75 years

(*ii*) anywhere from 4 to 6 years.

(F) Find the probability that a random variable having the standard normal distribution will take a value :

(*i*) between –0.34 and 0.62

(*ii*) greater than 0.85.

4. Attempt any *two* of the following : [8 marks each]

(A) (*i*) Define normal distribution. State the nature of probability density curve of normal distribution.

(*ii*) In certain experiments, the error made in determining the solubility of a substance is a random variable X having uniform distribution over (–0.025, 0.025). Find the probability that such an error will be between 0.010 and 0.015. Also, find average error.

(B) (*i*) State any *four* properties of the distribution function of a continuous random variable X.

(*ii*) In a laboratory experiment, 18 determinations of the coefficient of friction between leather and metal yielded the following results :

0.59, 0.56, 0.49, 0.55, 0.65, 0.55, 0.51, 0.6, 0.56, 0.47, 0.58, 0.61, 0.54, 0.68, 0.56, 0.5, 0.57, 0.53.

Test the null hypothesis that the median is 0.55 against it is not. Use 5% level of significance.

(C) (*i*) Explain the method of drawing a model sample from $N(\mu, \sigma^2)$ distribution using Box-Muller transformation.

(*ii*) An airline claims that 6% of all lost luggage is never found. If in a random sample, 17 of 200 pieces of lost luggage are not found. Test the validity of the claim of 6% against it is greater than 6% at 5% level of significance.

(D) (*i*) Describe procedure of Run-test.

(*ii*) The distribution function of a r.v. X is given by :

$$F(x) = \begin{cases} \dfrac{x^3 + 1}{9}, & -1 \le x \le 2 \\ 1, & x > 2 \end{cases}$$

Evaluate $P(0 < x \le 1)$. Also, obtain probability density function of X.

5. Attempt any *one* of the following :

(A) (*i*) Define each of the following : [4]

Statistic

Standard error

Critical region

One tailed test.

(*ii*) The demand for washing machine in a certain city is found to vary from day to day. In a sample study the following data was obtained : [4]

Day	**Number of Washing Machine Demanded**
Mon.	115
Tue.	126
Wed.	120
Thurs.	110
Fri.	125
Sat.	124

Test whether the demand for washing machine is indepednent of the day of the week. Use 5% level of significance.

(*iii*) The following are the average weekly losses of worker-hours due to accidents in 10 industrial plants before and after a certain safety program was put into operation :

Before	**After**
45	36
73	60
46	44
124	119
33	35
57	51
83	77
34	29
26	24
17	11

Test whether the safety program is effective. Use 5% level of significance. [8]

(B) (*i*) Explain the large sample test for testing $H_0 : \mu = \mu_0$ against $H_1 : \mu \neq \mu_0$. [4]

(*ii*) A random sample of 90 adults is classified according to gender and the number of hours they worked on computers during a week :

Gender / Working on Computers	Male	Female
Over 15 hours	29	15
Below 15 hours	19	27

Test the hypothesis that the time spent working on computers is independent of gender. Use 5% level of significance. [4]

(*iii*) An engineer found that by including small amounts of a compound in rechargeable batteries for portable computers, she could extend their lifetimes. She experimented with different amounts of the additive and the data are :

Amount of Additive X	Life (Hours) Y
0	2
1	4
2	3
3	7
4	9

(1) Compute the value of regression coefficient of Y on X and

(2) Test the significance of regression coefficient of Y on X at 10% level of significance. [8]