UG–334	BMS–31/ BMC–31

B.Sc. DEGREE EXAMINATION — JUNE, 2019.

Third Year

Mathematics with Computer Applications

REAL AND COMPLEX ANALYSIS

Time : 3 hours Maximum marks : 75

SECTION A — (5 × 5 = 25 marks)

Answer any FIVE questions.

1. Prove that the interval [0, 1] is uncountable.

2. Define an open set and prove that in any metric space every open ball is an open set.

3. Define continuity of a function at a point. Examine whether the function $f(x)=\begin{cases}\frac{|x|}{x}, & x \neq 0 \\ 0, & x=0\end{cases}$ is continuous or not?

4. Find an open covering of $E=(0,1)$ which does not contain a finite sub-covering.

5. Prove that every continuous function is Riemann-integrable.

6. State and prove Rolle's theorem.

7. Find the bilinear transformation which map points $z = 0, -i, -1$ into $w = i, 1, 0$.

8. State and prove Cauchy residue theorem.

SECTION B — (5 × 10 = 50 marks)

Answer any FIVE questions.

9. Prove that the set of all real numbers with usual metric is of second category.

10. Prove that the continuous image of a compact set is compact.

11. Prove that a subset of R is connected if and only if it is an interval.

12. State and prove chain rule for differentiable functions.

13. State and prove first fundamental theorem of integral calculus.

14. Show that the inversion transformation $w = \frac{1}{z}$ transforms circles in to circles or straight lines.

15. State and prove Cauchy Riemann equations.

16. Using Cauchy residue theorem/evaluate $\int_0^{2\pi} \frac{1}{a + b\cos\theta} d\theta, a > |b| > 0.$

UG–335	**BMS-32/ BMC-32**

B.Sc. DEGREE EXAMINATION — JUNE, 2019.

Third Year

Mathematics with Computer Applications

LINEAR ALGEBRA AND BOOLEAN ALGEBRA

Time : 3 hours Maximum marks : 75

SECTION A — (5 × 5 = 25 marks)

Answer any FIVE questions.

1. Define a subspace of a vector space and kernel of vector space homomorphism.

2. Prove that any subset of a linearly independent set in linearly independence.

3. Let $P_2(R)$ denote the set of all polynomials of degree at most 2. Examine whether the set $\{1-2x-2x^2, -2+3x-x^2, 1-x+6x^2\}$ is a basis or not.

4. Suppose that $T : R^2 \to R^2$ is linear, $T(1,0) = (1,4)$, and $T(1,1) = (2,5)$. What is $T(2,3)$? Is T one-to one?

5. Use Gram-Schmidt process to compute the orthogonal vectors of the vectors

   {(1, 0,1,0), (1,1,1,1), (0,1,2, 1)} in R^4.

6. Find the quadratic form $q(x)$ corresponding to the symmetric matrix $\begin{pmatrix} 5 & -3 \\ -3 & 8 \end{pmatrix}$.

7. State and prove the Idempotent law of addition in a Boolean algebra.

8. What is a normal form? When do we say that a Boolean expression is in disjunctive normal form?

SECTION B — (5 × 10 = 50 marks)

Answer any FIVE questions.

9. State and prove fundamental theorem of homomorphism.

10. Let V be a vector space having finite basis. Prove that every basis for V contains the same number of vectors.

11. Let V and W be vector spaces of finite and equal dimension and let $T : V \to W$ be linear. Then prove the following are equivalent:

   (a) T is one-to-one

   (b) T is onto

   (c) $\text{rank}(T) = \dim(V)$.

12. State and prove Gram-Schmidt Orthogonalization theorem.

13. Suppose that $S = \{v_1, v_2, ..v_n\}$ is an orthonormal set in an n-dimensional vector space V and if W is any subspace of V then prove that

   $\dim(V) = \dim(W) + \dim(W^{\perp})$.

14. Reduce the qudratic form $3x^2 + 8y^2 - 24z^2 + 10yz + 10zx - 14xy$ to the canonical form and find its rank, index and signature. Also determine its nature.

15. Express $(x + y)(x + y + z')(y + z)$ as a function in conjunctive normal form and write the function $f = x'yz + yz' + y'$ in disjunctive normal form.

16. Define a lattice. If L is a lattice then prove that $a \wedge b = a$ if and only if $a \vee b = b$. Also prove that the relation $a \lesssim b$ defined by $a \wedge b$ or $a \vee b = b$ is a partial order on L.

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UG-336 **BMS–33/BMC-33**

B.Sc. DEGREE EXAMINATION –
JUNE, 2019.

Third Year

Mathematics

LINEAR PROGRAMMING AND OPERATIONS RESEARCH

Time : 3 hours Maximum marks : 75

SECTION A — (5 × 5 = 25 marks)

Answer any FIVE questions.

1. Explain the Big-M method of solving linear programming problems involving artificial variable.

2. Write the dual of the following problems

Maximize $Z = 3x_1 + 7x_2$

Subject to : $7x_1 + 5x_2 \leq 20$

$3x_1 + 7x_2 \leq 25$

$4x_1 + 7x_2 \leq 30$

$x_1, x_2 \geq 0$

3. Explain the following terms of the transportation problem.

   (a) Basic solution

   (b) Optimal solution.

4. Find the initial solution for the following transportation problem using north-west corner rule.

Availability

		A	B	C	
	1	5	4	3	6
Requirements	2	4	7	6	8
	3	2	5	8	12
	4	8	6	7	4
		8	10	12	

5. Solve the game whose pay-off matrix is

		B		
		I	II	III
	I	–3	–2	6
A	II	2	0	2
	III	3	–2	–4

6. Define travelling salesman problem and mention the necessary basic steps to solve it.

7. Mention some of the advantages and disadvantages of having inventory.

8. Explain EOQ problems with price brakes.

SECTION B — (5 × 10 = 50 marks)

Answer any FIVE questions.

9. Explain dual simplex method to solve L.P.P.

10. Use simplex method to solve the following L.P.P.

Maximize $Z = 4x_1 + 7x_2$

Subject to $4x_1 + 3x_2 \leq 12$

$3x_1 + 4x_2 \leq 12$

$x_1, x_2 \geq 0$

11. Find the optimal solution for the assignment problem with the following cost matrix.

	Area			
Salesman	W	X	Y	Z
A	11	17	8	16
B	9	7	12	6
C	13	16	15	12
D	14	10	12	11

12. Solve the following transportation problem.

	A	B	C	Supply
1	10	9	8	8
2	10	7	10	7
3	11	9	7	9
4	12	14	10	4
Demand	10	10	8	

13. Solve the following 2 × 2 game graphically.

Player B

Player A	B_1	B_2	B_3	B_4
A_1	2	1	0	–2
A_2	1	0	3	2

14. Explain (a) shortage cost (b) caring cost.

15. Explain queue discipline and Kendal's notation for representing queue models.

16. Explain the queueing model (M/M/1):(∞/FCFS).

UG – 337	**BMS–33N**

B.Sc. DEGREE EXAMINATION – JUNE 2019.

Third Year

Mathematics

OPTIMIZATION TECHNIQUES

(Batch Academic Year 2014-15 onwards)

Time : 3 hours Maximum marks : 75

PART A — (5 × 5 = 25 marks)

Answer any FIVE questions.

1. Explain the advantages of linear programming problems.

2. Obtain the dual of the following L.P.P:

   Maximize $z = 2x_1 + 3x_2 + x_3$ subject to the constraints $4x_1 + 3x_2 + x_3 = 6, x_1 + 2x_2 + 5x_3 = 4$;
   $x_1, x_2, x_3 \geq 0$

3. What is an assignment problem? Explain.

4. What is meant by unbalanced transportation problem?

5. Solve the following 2-person zero sum game:

Player B

$$\text{Player A} \quad \begin{bmatrix} 15 & 2 & 3 \\ 6 & 5 & 7 \\ -7 & 4 & 0 \end{bmatrix}$$

6. Describe briefly the EOQ concept.

7. Define the terms step-up cost holding cost and shortage cost as applied to an inventory problem

8. What is a queue? Explain the basic elements of queues.

PART B — (5 × 10 = 50 marks)

Answer any FIVE questions.

9. Use simplex method to solve the following L.P.P.

Maximize $z = 3x_1 + 2x_2 + 5x_3$ subject to the constraints

$x_1 + 4x_2 \le 420,$

$3x_1 + 2x_3 \le 460,$

$x_1 + 2x_2 + x_3 \le 430$

and $x_1 \ge 0, x_2 \ge 0, x_3 \ge 0.$

10. Show that the dual of the dual in the primal.

11. Consider the problem of assigning five jobs to five persons. The assignment costs are given as follows.

Job

Person		1	2	3	4	5
	A	8	4	2	6	1
	B	0	9	5	5	4
	C	3	8	9	2	6
	D	4	3	1	0	3
	E	9	5	8	9	5

Determine the optimum assignment schedule.

12. Solve the following transportation problems:

To

		A	B	C	Available
	I	50	30	220	1
From	II	90	45	170	3
	III	250	200	50	4
Requirement		4	2	2	

13. Solve the following game graphically:

Player B

Player A		B_1	B_2	B_3	B_4
	A_1	2	1	0	–2
	A_2	1	0	3	2

14. Solve the game using LP method:

$$A \overset{B}{\begin{pmatrix} 3 & -4 & 2 \\ 1 & -3 & -7 \\ -2 & 4 & 7 \end{pmatrix}}$$

15. A manufacturing company purchasing 9000 parts of a machine for its annual requirements ordering one month usage at a time. Each part costs Rs.20. The ordering cost per order is Rs15 and the carrying charges are 15% of the average inventory per year. You have been assigned to suggest a more economical purchasing policy for the company. What advice would you offer and how much would it save the company per year?

16. A foreign bank in considering opening a drive-in window for customer service. Management estimates that customers will arrive for service at the rate of 12 per hour. The taller whom it is considering to staff the window can serve customers at the rate of one every three minutes. Assuming Poisson arrivals and Exponential service, find:

    (a) Utilization of teller

    (b) Average number in the system

    (c) Average waiting time in the line

    (d) Average waiting time in the system.

UG – 338	BMS–34

B.Sc. DEGREE EXAMINATION – JUNE 2019.

Third Year

Mathematics

PROGRAMMING IN C AND C++

Time : 3 hours   Maximum marks : 75

PART A — (5 × 5 = 25 marks)

Answer any FIVE questions.

1. What are constants? How they are declared? Mention different constant types.

2. List and explain any five library functions in C.

3. Compare structures with Unions.

4. Discuss briefly about pointer declarations with examples.

5. What is operator overloading? Explain with an example.

6. Write a C program to find the average of given numbers.

7. Discuss the control structure in C.

8. Explain switch statement in C.

PART B — ($5 \times 10 = 50$ marks)

Answer any FIVE questions.

9. Write a C program to arrange the numbers in ascending and descending orders.

10. Explain about passing arrays to functions with an example C program.

11. How to pass a structure to a function? Explain.

12. Describe in detail File Handling functions in C with examples.

13. Discuss the different types of inheritance in C++ with examples

14. Discuss the key concepts OOP.

15. Explain the different types of constructors in C++.

16. Explain any four string handling functions in C.

UG–339	**BMS–35**

B.Sc. DEGREE EXAMINATION — JUNE, 2019.

Third Year

Mathematics

GRAPH THEORY

Time : 3 hours Maximum marks : 75

SECTION A — (5 × 5 = 25 marks)

Answer any FIVE questions.

1. Define an isomorphism of graphs and give an example.

2. Show that every graph is an intersection graph.

3. Prove that a vertex v of a tree G is a cut vertex of G if and only if $d(v) > 1$.

4. Prove that every tree has a centre consisting of either one point or two adjacent points.

5. If G is a graph in which the degree of each vertex is at least 2, then prove that G contains a cycle.

6. Prove that any subset of an independent set is independent.

7. Prove that a map G is 2-face colourable if and only if G is eulerian.

8. If G is a tree with n-points $n \geq 2$, then prove that $f(G, \lambda) = \lambda(\lambda - 1)^{n-1}$.

SECTION B — (5 × 10 = 50 marks)

Answer any FIVE questions.

9. Show that the sum of the degrees of the vertices of a graph is equal to twice the number of its edges.

10. If A is the adjacency matrix of G, then prove that the number of (v_i, v_j)-walks of length k in G is the $(i, j)^{\text{th}}$ entry of A^k.

11. Show that every non-trivial connected graphs has at least two points which are not cut points.

12. Let G be a (p, q) graph. Prove that the following statements are equivalent.

    (a) G is a tree

    (b) Every two points of G are joined by a unique path

    (c) G is connected and $p = q + 1$

    (d) G is acyclic and $p = q + 1$.

13. Prove that $C(G)$ is well defined.

14. If G is a graph with $p \geq 3$ vertices and $\delta > \frac{p}{2}$ then prove that G is Hamiltonian.

15. If G is a connected plane graph having V, E and F as the sets of vertices, edges and faces respectively, then show that $|V| - |E| + |F| = 2$.

16. Prove that every tournament has a spanning path.

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