UG-AS-1340 **BMSS-11/ BMSS-11C**

U.G DEGREE EXAMINATION – JULY 2024.

Mathematics

First Semester

ALGEBRA

Time : 3 hours Maximum marks : 70

SECTION A — (3 × 3 = 9 marks)

Answer any THREE questions.

1. Form a rational cubic equation which shall have for roots 1, 3, $-\sqrt{-2}$.

2. Diminish the roots of $x^4 - 5x^3 + 7x^2 - 4x + 5 = 0$ by 2.

3. Define Symmetric Matrix.

4. What is meant by Prime Number.

5. Write a note on Congruence.

SECTION B — (3 × 7 = 21 marks)

Answer any THREE questions.

6. Solve the equation $8x^3 + 14x^2 + 7x + 1 = 0$ whose roots are in geometrical progression.

7. Increase by 7 the roots of an equation $3x^4 + 7x^3 + 15x^2 + x + 2 = 0$.

8. Prove that the inverse of an orthogonal matrix is orthogonal.

9. Prove Every composite number can be resolved in to prime factors uniquely.

10. Show that $(18)!+1$ is divisible by 437.

SECTION C — (4 × 10 = 40 marks)

Answer any FOUR questions.

11. Solve the equation $x^4 + 2x^3 + 21x^2 + 22x + 40 = 0$ whose roots are in arithmetic progression.

12. Solve the equation $x^4 + 20x^3 + 143x^2 + 430x + 462 = 0$ by removing its second term.

13. If A is a square matrix of order n; then show that $A + A^T$ is symmetric and AA^T is skew-symmetric.

14. Find the sum of the positive integers including unity which are less than 600 and prime to it.

15. Show that $13^{2n+1} + 9^{2n+1}$ indivisible by 22.

16. Solve $6x^6 + 35x^5 + 56x^2 + 35x + 6 = 0$.

17. Increase the roots of $x^4 + 16x^3 + 83x^2 + 152x + 84 = 0$ by 4 and hence solve the equation.

UG-AS-1341	**BMSSE–11/ BMSSE-11C**

U.G. DEGREE EXAMINATION — JULY 2024

Mathematics

First Semester

TRIGONOMETRY

Time : 3 hours Maximum marks : 70

PART A — ($3 \times 3 = 9$ marks)

Answer any THREE questions.

1. Expand $\cos^5 \theta$.

2. Expand $\sin^6 \theta$

3. Expand $\sin \theta$.

4. Find $\log(x + iy)$

5. Write the types of series.

PART B — ($3 \times 7 = 21$ marks)

Answer any THREE questions.

6. Expand $\cos^{11} \theta$ in a series of cosines of multiples of θ.

7. Express $\cos 8\theta$ in terms of $\sin \theta$.

8. Find the real and imaginary parts of $\cos(x+iy)$

9. Find the real and imaginary parts of log $\log(\cos\theta + i\sin\theta)$.

10. Find the sum to infinity for the series $\cos\theta\cos\theta + \cos^2\theta\cos 2\theta + \cos^3\theta\cos 3\theta + \ldots$

PART C — (4 × 10 = 40 marks)

Answer any FOUR questions.

11. Find the expansion of $\sin^7\theta$ in a series of sines of multiples of θ.

12. If $\cos\theta = \frac{1681}{1682}$ show that θ is approximately equal to 2°.

13. If $\cos(x+i\hat{y}) = \cos\theta + i\sin\theta$, prove that $\cos 2x + \cosh 2y = 2$.

14. If $i^{a+ib} = a+ib$, prove that $\alpha^2 + b^2 = e^{-(4n+1)}\pi\beta$.

15. Find the sum of the series $\cos ec\theta + \cos ec2\theta + \cos ec2^2\theta + \ldots + \cos es2^{\eta-1}\theta$.

16. Expand $\sin^8\theta$ in a series of cosines of multiples of θ.

17. Find the real and imaginary parts of $\tanh(x+iy)$.

UG-AS-1342 BPHYSA-11/ BPHYSA-11C

U.G. DEGREE EXAMINATION – JULY, 2024.

Physics

First Semester

ALLIED PHYSICS – I

Time : 3 hours Maximum marks : 70

PART A — ($3 \times 3 = 9$ marks)

Answer any THREE questions out of Five questions in 100 words

All questions carry equal marks

1. Enlist the properties and uses of ultrasonic waves.

2. Define coefficient of viscosity. Write down the Poiseuille's formula.

3. State the second law of thermodynamics. Give its use.

4. State the Biot Savart's Law. Mention its use.

5. Define spherical and chromatic aberration in lenses.

PART B — ($3 \times 7 = 21$ marks)

Answer any THREE questions out of Five questions in 200 words

All questions carry equal marks

6. Discuss any five factors for good acoustics of buildings.

7. Derive an expression for the period of a torsional pendulum.

8. (a) Give the theory of Joule-Kelvin effect.

   (b) Write a note on Reversible and Irreversible processes.

9. Derive an expression for the r.m.s value and average value of an alternating current.

10. Describe the air-cell method of determining the refractive index of a liquid.

PART C — ($4 \times 10 = 40$ marks)

Answer any FOUR questions out of Seven questions in 500 words

All questions carry equal marks.

11. Find the resultant of two simple harmonic vibrations of equal periods, acting at right angles to each other. Also give the special cases.

12. Describe static torsion method with theory to determine the rigidity modulus of a cylindrical rod.

13. Explain the porous plug experiment. Discuss the significance of the experiment in liquefaction of gas.

14. Derive an expression for the field along the axis of a circular coil carrying current.

15. Explain how two narrow angled prisms can be combined to produce deviation without dispersion. Derive the condition to be satisfied.

16. With neat sketch, explain the construction and working of piezoelectric oscillator method to produce the ultrasonic waves. Mention the advantages and disadvantages of this method.

17. Describe Jaegar's method to determine the surface tension of liquid. Also give the drawbacks of this method.

UG–AS-1343	**BMSS–21**

U.G. DEGREE EXAMINATION — JULY 2024.

Mathematics

Second Semester

DIFFERENTIAL CALCULUS

Time : 3 hours Maximum marks : 70

PART A — ($3 \times 3 = 9$ marks)

Answer any THREE questions.

1. Find n^{th} derivative of e^{ax}.

2. The n^{th} derivative of $fu = xy^2 + x^2y$ where $x = at$; $y=2$ at is

3. Define the radius of a curvature at the point.

4. Define Envelope.

5. Define Asymptote.

PART B — $(3 \times 7 = 21$ marks)

Answer any THREE questions.

6. Find the n^{th} derivative of $\sin^3 2x$.

7. Find the shortest and the longest distance from the point (1, 2, 1) to the sphere $x^2 + y^2 + z^2 = 24$.

8. Find the radius of curvature of the curve $xy^2 = a^3 x^3$ at the point $(a, 0)$.

9. Show that in the curve $r = a$ the polar subtangent varies as the square of the radius vector and the polar subnormal is constant.

10. Find the asymptotes of $x^2 y^2 = a^2 x^2 + y^2$.

PART C — $(4 \times 10 = 40$ marks)

Answer any FOUR questions.

11. Find the n^{th} derivative of $\sin 2x \sin 4x \sin 6x$.

12. Investigate the maximum and minimum value of $4x^2 + 6xy + 9y^2 + 8x + 24y + 4 = 0$.

13. Find the angle between the curves $r = 2\,a\cos\theta$ and $r = 2\,a\sin\theta$.

14. Write the procedure to find the asymptote of a curve.

15. Solve

$$y^3 + x^2 y + 2xy^2 + 2x^3 + 7xy + 3y^2 + 2x^2 + 2x + 2y + 1 = 0 .$$

16. Find the nth derivative of $x^2 \sin 5x$.

17. Show that if the perimeter of a triangle is constant its areas is maximum when the triangle is equilateral.

UG–AS–1344 **BMSSE–21**

U.G. DEGREE EXAMINATION — JULY 2024.

Mathematics

Second Semester

ANALYTICAL GEOMETRY

Time : 3 hours Maximum marks : 70

PART A — (3 × 3 = 9 marks)

Answer any THREE questions.

1. Find the equation of the parabola with the following foci $(1,2)$ and directrix $x + y - 2 = 0$.

2. Prove that any two conjugate diameters of a rectangular hyperbola are equally inclined to the asymptotes.

3. Write the general equation of a plane.

4. Find the angle between the line $-\frac{x-1}{2} = \frac{y}{3} = \frac{z-3}{6}$ and the plane $3x + y + z = -7$.

5. Write the standard equation of the sphere.

PART B — $(3 \times 7 = 21$ marks)

Answer any THREE questions.

6. Find the condition that the straight line $lx + my + n = 0$ is a tangent to the parabola.

7. Prove that tangents at the extremities of a pair of Conjugate Diameters of an ellipse encloses a parallelogram whose area is constant.

8. Find the equation of the plane passing through the points $(1,-2,2)$ and $(-3,1,-2)$ and Perpendicular to the plane $2x + y - z + 6 = 0$.

9. Find the equation of the plane which contains the line and is perpendicular to the plane $x + 2y + z = 12$.

10. Find the equation of the sphere with centre $(-1,2,-3)$ and radius 3 units.

PART C — $(4 \times 10 = 40$ marks)

Answer any FOUR questions.

11. Find the equation of the ellipse whose Foci are $(4,0)$ and $(-4,0)$ and $e = 1/3$.

12. Find the equation of the tangent at the point whose vectorial angle is α on the conic $\mathcal{L} = 1 + e\cos\theta$.

13. Find the angle between the planes $2x + 4y - 6z = 11$ and $3x + 6y + 5z + 4 = 0$.

14. Prove that the points (3, 2, 4) (4, 5, 2) and (5, 8, 0) are collinear.

15. Find the equation of the sphere that passes through the circle $x^2 + y^2 + z^2 + x - 3y + 2z - 1 = 0, 2x + 5y - z + 7 = 0$ and cuts orthogonally the sphere whose equation $x^2 + y^2 + z^2 - 3x + 5y - 7z - 6 = 0$.

16. Find the centre, foci and eccentricity of $12x^2 - 4y^2 - 24x + 32y - 127 = 0$.

17. Find the equation of the plane which passes through the points $(1, 0, -1)$ and $(2, 1, 1)$ and parallel to the line joining the points $(-2, 1, 3)$ and $(5, 2, 0)$.

UG–AS–1345 BPHYSA–22

U.G. DEGREE EXAMINATION — JULY 2024.

Physics

Second Semester

ALLIED PHYSICS – II

Time : 3 hours Maximum marks : 70

PART A — ($3 \times 3 = 9$ marks)

Answer any THREE questions out of Five questions in 100 words.

All questions carry equal marks.

1. What is optical activity? Give uses of polarimeter.

2. State Pauli's exclusion principle. Mention its significance.

3. What are mass defect and binding energy?

4. Give the Postulates of theory of relativity.

5. State De Morgan theorems.

PART B — $(3 \times 7 = 21$ marks)

Answer any THREE questions out of Five questions in 200 words.

All questions carry equal marks.

6. Describe the air wedge method for determining the thickness of a thin wire.

7. Derive the expression for the magnetic dipole moment due to orbital motion of the electron.

8. Describe the liquid drop model of nucleus.

9. Derive the Schrodinger's time dependent equation.

10. Show that the NOR gate as an universal building block.

PART C — $(4 \times 10 = 40$ marks)

Answer any FOUR questions out of Seven questions in 500 words.

All questions carry equal marks.

11. Explain the theory of transmission grating.

12. Explain the different quantum numbers associated with vector atom model.

13. Explain:

    (a) Nuclear reactor,

    (b) Thermonuclear reactions.

14. (a) Derive Schrodinger's equation for a particle in a box. Obtain its eigen values and eigen functions.

    (b) Write a note on time dilation.

15. (a) Sketch the diagram of Wein's bridge oscillator and explain its working.

    (b) Reduce the following equation using laws of Boolean algebra: $AB + ABC + \overline{A}B + A\overline{B}C$.

16. Explain the principle and working of fission controlled and uncontrolled chain reaction.

17. Write the notes on

    (a) Colours of thin films,

    (b) Test for optical flatness, and

    (c) Double refraction.

UG–AS-1346	BMSS–31

U.G. DEGREE EXAMINATION — JULY 2024.

Mathematics

Third Semester

INTEGRAL CALCULUS

Time : 3 hours Maximum marks : 70

PART A — (3 × 3 = 9 marks)

Answer any THREE questions.

1. Reduction formula for $\int x^n e^{ax} dx$,, where n isa positive integer.

2. Find the volume to the segment of height of a sphere of radius a.

3. Evaluate $\int_0^x \frac{1}{a^z + x^2 dx}$.

4. Find $\nabla\phi$ at (1, 1, 1) if $\phi = x^2 y + y^2 x + z^2$.

5. Prove that $\nabla.(\vec{A} \times \vec{B}) = \vec{B}.(\nabla \times \vec{A}) - \vec{A}(\nabla \times \vec{B})$.

PART B — $(3 \times 7 = 21$ marks)

Answer any THREE questions.

6. Evaluate $\int x^2 \cos 3x dx$.

7. Evaluate $\iint xy\ dx\ dy$ taken over the positive quadrant of the circle $x^2 + y^2 = a^2$.

8. Prove that $I'(n+1) = n!$

9. If f and g are two scalar point function, then prove that $\nabla(f+g) = \nabla f + \nabla g$.

10. Show that the surfaces $5x^2 + 2y - 9x = 0$ and $4x^2 y + z^3 - 4 = 0$ are orthogonal at (1, -1, 2).

PART C — $(4 \times 10 = 40$ marks)

Answer any FOUR questions.

11. Derive Reduction formula for $\int \sin^n x dx$ where n is a positive integer.

12. Evaluate $\iiint xyz\ dxdydz$ taken through the positive octant of the sphere $x^2 + y^2 + z^2 = a^2$.

13. Prove that $\beta(m,n) = \dfrac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$.

14. Find the maximum value of the directional derivative (or the Normal derivative) of the function $2x^2 + 3y + 5z^2$ at $(1,1,-4)$.

15. If $xyz\vec{i} + xyz^2\vec{j} + x^2yz\vec{k}$ then find div (curl $\vec{F}$).

16. Evaluate $\int x^3 \sin 2x dx$.

17. By changing into polar coordinates evaluate $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dx dy$.

UG–AS-1347	BMSS–32

U.G. DEGREE EXAMINATION — JULY 2024.

Mathematics

Third Semester

DIFFERENTIAL EQUATION

Time : 3 hours Maximum marks : 70

PART A — ($3 \times 3 = 9$ marks)

Answer any THREE questions.

1. Solve $ydx - xdy + 3x^2 y^2 e^{x^3} dx = 0$.

2. Solve: $\left(D^2 - 5D + 4\right) y = 0$.

3. Solve $\left(D^2 - 4D + 3\right) y = 10 \cos x$ using method of undetermined coefficients.

4. Solve the equations $\frac{dx}{yz} = \frac{dy}{xz} = \frac{dz}{xy}$.

5. Form the partial differential equation by eliminating a and b from $z = \left(x^2 + a\right)\left(y^2 + b\right)$.

PART B — $(3 \times 7 = 21$ marks)

Answer any THREE questions.

6. Solve $(x+y-1)\,dy = (x+y+1)\,dx$.

7. Solve $\left(D^2 - 2D + 1\right) y = e^{3x}$.

8. Solve $\frac{d^2y}{dx^2} + n^2 y = \sec nx$ using method of variation of parameter.

9. Solve $\frac{dx}{x(y-z)} = \frac{dy}{y(z-x)} = \frac{dz}{z(x-y)}$.

10. Eliminate f and ϕ from $z = f(x+ay) + \phi(x-ay)$.

PART C — $(4 \times 10 = 40$ marks)

Answer any FOUR questions.

11. Solve $xdy - ydx = \sqrt{x^2 + y^2}\,dx$.

12. Solve $\left(D^2 - 3D + 2\right)y = \sin 3x$.

13. Solve $x^3 \frac{d^3y}{dx^3} + 3x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = x + \log x$.

14. Solve $\left(1+x+x^2\right)\frac{d^3 y}{dx^3}+(3+6x)\frac{d^2 y}{dx^2}+6\frac{dy}{dx}=0$.

15. Solve $x(y-z)p+y(z-x)q=z(x-y)$.

16. Solve $\left(a^2-2xy-y^2\right)dx-(x+y)^2 dy=0$.

17. Solve $\left(D^2-4D+13\right)y=e^{2x}\cos 3x$.

UG–AS-1348 BMSSA–31

U.G. DEGREE EXAMINATION — JULY 2024.

Mathematics

Second Year

COMPUTER FUNDAMENTALS AND PC SOFTWARE

Time : 3 hours Maximum marks : 70

PART A — ($3 \times 3 = 9$ marks)

Answer any THREE questions out of Five questions in 100 words

All questions carry equal marks

1. What are the four stages of instruction pipeline?
2. What is Parallel transmission?
3. What do you mean by ruler?
4. Differentiate between a presentation and a slide.
5. What is the Recycle bin?

PART B — ($3 \times 7 = 21$ marks)

Answer any THREE questions out of Five questions in 200 words

All questions carry equal marks

6. Explain briefly about vector operations.

7. Explain the role of cryptography.

8. Write the steps to insert Header and Footer.

9. Differentiate between slide Transition and Custom Animation.

10. Explain about different tools available in multimedia

PART C — ($4 \times 10 = 40$ marks)

Answer any FOUR questions out of Seven questions in 500 words.

All questions carry equal marks.

11. Describe how the performance of the instruction pipeline can be improved.

12. Discuss in detail about LAN and WAN.

13. Discuss about Mail Merge in MS-Word.

14. Explain the various views of a slide available in PowerPoint.

15. Explain the use of charts in PowerPoint.

16. Explain in detail about Disk Drive Utilities.

17. How do you check spellings and grammar of a MS Word document? Explain.

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UG–AS–1349	BMSS–41

U.G. DEGREE EXAMINATION — JULY 2024.

Mathematics

Fourth Semester

TRANSFORM TECHNIQUES

Time : 3 hours — Maximum marks : 70

PART A — $(3 \times 3 = 9$ marks)

Answer any THREE questions out of Five questions in 100 words.

All questions carry equal marks.

1. Find Laplace Transform of a unit function.

2. Find $L^{-1}\left[\frac{s}{s^2-10}\right]$.

3. Write Half Range Fourier Cosine series.

4. Find the Fourier cosine transform of $f(x)=x$.

5. Working Rule to solve the differential equation by Laplace transform method.

PART B — $(3 \times 7 = 21$ marks)

Answer any THREE questions out of Five questions in 200 words.

All questions carry equal marks.

6. Verify the initial and final value theorems for $f(t) = 1 - e^{-at}$.

7. Find $L^{-1}\left[\log\left(\frac{s^2+1}{s-3}\right)\right]$.

8. Expand $\cos x$ in $(0,1)$ as Fourier sine series.

9. Find the Inverse Fourier cosine transforms of $\frac{\sin as}{s}$.

10. Solve $\frac{\partial y}{\partial x} = 2\frac{\partial y}{\partial t} + Y, Y = (X,0) = 6e^{-3x}$ given that $x > 0, t > 0$.

PART C — $(4 \times 10 = 40$ marks)

Answer any FOUR questions out of Seven in 500 words each.

11. (a) Find $L\left[e^{2t}\sin 2t \cos t\right]$.

(b) Evaluate $\int_0^\infty \frac{e^{-t} - e^{-2t}}{t} dt$.

12. Find $L^{-1}\left[\frac{s-3}{s^2+5s+6}\right]$.

13. Find the Fourier series for the function $f(x)=\left(\frac{\pi-x}{2}\right)^2$ in the interval $(0,2\pi)$ and hence obtain $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+.....=\frac{\pi^2}{12}$.

14. If $F[s]$ is the Fourier transform of $f(x)$, then $\int_{-\infty}^{\infty}|f(x)|^2\,dx=\int_{-\infty}^{\infty}|F(s)|^2\,ds$.

15. Using Laplace transform, solve $\frac{dx}{dt}+y=\sin t;\frac{dy}{dt}+x=\cos t$ given that $x=2, y=0$ when $t=0$.

16. In the range $(0,2l), f(x)$ is defined by the relations $f(x)=0$ when $0<x<l$

$=a$ when $l<x<2l$.

Find Fourier series for $f(x)$ is $(0,2l)$.

17. (a) If $F(s)$ is the Fourier transform of $f(x)$, then $F[f(x)\cos ax]=\frac{1}{2}[F(s+a)+F(s-a)]$

(b) Prove that $F[f(x-a)]=e^{iax}F(s)$.

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UG–AS–1350	BMSS–42

U.G. DEGREE EXAMINATION — JULY 2024.

Mathematics

Fourth Semester

ALGEBRAIC STRUCTURE

Time : 3 hours Maximum marks : 70

PART A — ($3 \times 3 = 9$ marks)

Answer any THREE questions out of Five questions in 100 words.

All questions carry equal marks.

1. Define Binary Relation and give an example.

2. In a group the left and right cancellation law hold $ab = ac \Rightarrow b = c$ and $ba = ca \Rightarrow b = c$.

3. Define normal subgroup and give an example.

4. Define unit and field.

5. Define ascending chain condition (ACC).

PART B — $(3 \times 7 = 21$ marks)

Answer any THREE questions out of Five questions in 200 words.

All questions carry equal marks.

6. Prove by induction method for $n \geq 1$.

$$\sum_{n=1}^{n} n^2 = \frac{n(n+1)(2n+1)}{6}.$$

7. Prove that if H and K are abelian groups then is $H \times K$ also an abelian group.

8. State and proves Euler's Theorem.

9. Let R be a ring with identity. Prove that the set of all units in R is a group under multiplication.

10. Let R be an integral domain. Let a and b be two non-zero element of R. Then a and b are associates iff $a = bu$ where u is a unit in R.

PART C — $(4 \times 10 = 40$ marks)

Answer any FOUR questions out of Seven questions in 500 words.

All questions carry equal marks.

11. (a) Find the domain and range of the function $f(x) = \dfrac{x^2 - 3x - 2}{x^2 + x - 6}$.

(b) List out all the elements of $A \times B$. Given $A = \{1,2,3\}$ and $B = \{x, y\}$.

12. (a) The union of two subgroups of a group G is a subgroup if and only if one is contained in the Other

(b) Prove that a subgroup of cyclic group is cyclic.

13. (a) Prove that Isomorphism is an equivalence relation among the groups.

(b) Prove that any infinite cyclic group G is isomorphic to $(Z,+)$.

14. (a) A ring R has no zero divisors iff cancellation law is valid in R

(b) Prove that the characteristic of an integral domain D is either 0 or a prime number.

15. Prove that any Euclidean domain R is a U.F.D.

16. State and prove Fundamental theorem of homomorphism.

17. (a) Let R be a commutative ring with identity. Then prove that R is a field iff R has no proper ideals.

(b) Let R be any commutative ring with identity. Let P be an ideal of R. Then show that P is a prime ideal $\Leftrightarrow R/P$ is an integral domain.

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UG–AS–1351	BMSSA–42

U.G. DEGREE EXAMINATION — JULY 2024.

Mathematics

Fourth Semester

PROGRAMMING IN C

Time : Three hours Maximum marks : 70

SECTION A — (3 × 3 = 9 marks)

Answer any THREE questions out of Five questions in 100 words.

All questions carry equal marks.

1. What is a keywords?

2. What is Go to statement?

3. What is a Function?

4. Define Arrays.

5. List out the Operation in pointers.

SECTION B — $(3 \times 7 = 21$ marks)

Answer any THREE questions out of five questions in 200 words.

All questions carry equal marks.

6. Explain the primary data types.

7. Write short notes on Simple C program.

8. Write a C program to check the given number is prime or not.

9. Explain about array with example.

10. Discuss about the Opening file.

SECTION C — $(4 \times 10 = 40$ marks)

Answer any FOUR questions out of Seven questions in 500 words.

All questions carry equal marks.

11. Discuss about the Relational and logical operators with example?

12. Write about the If-else statements give example.

13. Write a program to print the sum and difference of two 2*2 matrices?

14. Discuss about storage classes with example.

15. Write short on Structure and Unions.

16. Explain about the Bit wise Operators.

17. Describe the branching structures in C with example.

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UG-AS-1352	**BMSS-51**

U.G. DEGREE EXAMINATION – JULY 2024.

Mathematics

Fifth Semester

REAL ANALYSIS – I

Time : 3 hours

Maximum marks : 70

PART A — ($3 \times 3 = 9$ marks)

Answer any THREE questions out of Five questions in 100 words

All questions carry equal marks

1. Define The Composition of Function.

2. Prove that all divergent sequences are not bounded.

3. Prove that $\lim_{n\to\infty} \frac{3n^2 - 6n}{5n^2 + 4} = \frac{3}{5}$.

4. Examine the convergence of the series $1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \cdots$.

5. Define a metric spaces.

PART B — $(3 \times 7 = 21$ marks)

Answer any THREE questions out of Five questions in 200 words

All questions carry equal marks

6. If $f : A \to B$ and the range of f is uncountable, prove that the domain of *f* is uncountable.

7. A non-increasing sequence which is bounded below is convergent.

8. Show that $\sum_{n=1}^{\infty} a_n$ converges if and only if given $\varepsilon > o$ there exists $n \in I$ such that $\left|\sum_{k=m+1}^{\infty} a_k\right| < \varepsilon (m, n \geq N)$.

9. Examine the convergence of the series $\sum_{n=1}^{\infty} \frac{\left(1+\frac{1}{n}\right)^{2n}}{e^n}$

10. If f and g are real - valued functions and if f is continuous at 'a' and if g is continuous at $f(a)$ then $g \circ f$ is continuous at a.

PART C — ($4 \times 10 = 40$ marks)

Answer any FOUR questions out of Seven questions in 500 words

All questions carry equal marks

11. (a) If $A_1, A_2, \cdots$ are countable sets, then $\bigcup_{n=1}^{\infty} A_n$ is also countable. In other words, countable union of countable sets is countable.

(b) If A is a non-empty subset of R and let A be a bounded below set. Then A has a greatest lower bound (g.l.b) in R.

12. Show that $\{|S_n|\}_{n:1}^{\infty}$ converges to $|L|$, if $\{S_n\}_{n=1}^{\infty}$ converges to L^2.

13. (a) If $\{S_n\}_{n=1}^{\infty}$ is a Cauchy sequence of real number then $\{S_n\}_{n:1}^{\infty}$ is convergent.

(b) If $\sum_{n=1}^{\infty} a_n$ is a convergent series then $\lim_{n \to \infty} a_n = 0$.

14. (a) If $\sum_{n=1}^{\infty} a_n$ converges absolutely then the series $\sum_{n=1}^{\infty} a_n$ converges.

(b) State and prove *D*' Alembert Ratio Test.

15. Let M be a metric space, and let f and g be real-valued functions which are continuous at $a \in M$. Then $f+g$, $f-g$ and fg are also continuous at a. Further more, if $g(a) \neq 0$, then f/g is continuous at a.

16. Let f be non-decreasing function on the bounded open inter (a, b). If f is bounded above on (a, b), $\lim_{x \to b-} f(x)(x)$ exists. Also, if f is bounded below (a, b) then $\lim_{x \to a-} f(x)$ exists.

17. The sequence $\left\{\left(1+\frac{1}{n}\right)^n\right\}_{n=1}^{\infty}$ is convergent.

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U.G. DEGREE EXAMINATION — JULY 2024.

Mathematics

Fifth Semester

LINEAR ALGEBRA

Time : 3 hours Maximum marks : 70

PART A — ($3 \times 3 = 9$ marks)

Answer any THREE questions out of Five questions in 100 words.

All questions carry equal marks.

1. Prove that the union of two subspaces of a vector space need not be a subspace.

2. Define (a) Homomorphism (b) Dual Space.

3. If $u \in V$ and $\alpha \in F$ then $\|\alpha u\| = |\alpha| \, \|u\|$.

4. Define Inner Product Space.

5. Write a short notes of Matrix of a Linear Transformation.

PART B — $(3 \times 7 = 21$ marks)

Answer any THREE questions out of Five questions in 200 words

All questions carry equal marks.

6. $T : R^2 \to R^2$ defined by $T(x) = T(x, y) = (x + 2, x - y)$ is not a linear transformation.

7. If $L(\{(1,2,3),(0,4,-1)\})$ then find $A(W)$.

8. State and prove the Pythagorus Theorem

9. Prove that Hom (V,V) forms an algebra over F.

10. In F_2 prove that for any two elements A and $B, (AB - BA)^2$ is a scalar matrix.

PART C — $(4 \times 10 = 40$ marks)

Answer any FOUR questions out of Seven questions in 500 words

All questions carry equal marks.

11. If V is a vector space over F and if W is a subspace of V, then V/W is a vector space over F, where for $v_1 + W$, $v_2 + W \in V/W$ and $\alpha \in F$ under the following operations:

   (a) $(v_1 + W) + (v_2 + W) = (v_1 + v_2) + w$

   (b) $\alpha(v_1 + W) = \alpha v_1 + W$.

12. Let V and W are vector spaces of dimensions m and n respectively, over F. Then show that $Hom(V,W)$ is of dimension mn over F.

13. If V is finite-dimensional, then show that V is isomorphic to V.

14. If V is finite-dimensional over F, then show that $T \in A(V)$ is invertible if and only if the constant term of the minimal polynomial for T is not 0.

15. If $T \in A(V)$ has all its characteristic roots in F, then show that there is a basis of V in which the matrix of T is triangular

16. Let V be a vector space of dimension n. Then show that V is isomorphic to $F^{(n)}$

17. (Gram Schmidt Orthogonalization Process). Let V be a finite-dimensional inner product space, then show that V has an orthonormal set as a basis.

UG-AS-1354	**BMSS-53**

U.G. DEGREE EXAMINATION – JULY 2024.

Mathematics

Fifth Semester

DISCRETE MATHEMATICS

Time : 3 hours   Maximum marks : 70

PART A — ($3 \times 3 = 9$ marks)

Answer any THREE questions out of Five questions in 100 words

All questions carry equal marks

1. Define set and give an example.

2. Write Divisibility of Integers and their Properties.

3. Write simpler circuit.

4. Define Sequence and examples.

5. Write simple graph.

PART B — ($3 \times 7 = 21$ marks)

Answer any THREE questions out of Five questions in 200 words

All questions carry equal marks

6. (a) Show that any postage more than seventeen paise can be done by using just 4 paise and 7 paise stamps.

   (b) Prove that $7^n - 1$ is divisible by 6 for all integers $n \geq 0$.

7. (a) Find a Boolean polynomial p that induces the function f.

   (b) Find a disjunctive normal form of $p = \left((x_1 + x_2')\ x_1 + x_2'''\right)' + x_1\, x_2 + x_1\, x_2'$.

8. (a) Switch Implementation.

   (b) Logic Gate Implementation.

9. Prove the following by Mathematical Induction: $1 + 3 + 5 + ... + 2n - 1 = n^2$.

10. Closed walk of odd length contains a cycle.

PART C — ($4 \times 10 = 40$ marks)

Answer any FOUR questions out of Seven questions in 500 words

All questions carry equal marks

11. De Morgan's Law : Let A and B be subset of a set S. Then

    (a) $(A \cup B)' = A' \cap B'$ and

    (b) $(A \cap B)' = A' \cup B'$

12. Write a DNF $(x+y)\,(x+y')\,(x'+y)\,(x'+y')$.

13. Write The Switching Theory of Series Switches.

14. Solve the recurrence relation $a_{r+2} - 3a_{r+1} + 2a_r = 0$. By the method of generating functions with the initial conditions $a_0 = 2,\ a_1 = 3$.

15. A connected and nontrivial graph G is Eulerian if and only if all of its vertices have even degree.

16. Solve the recurrence relation $a_n = a_{n-1} + f(n)$ for $n^3 - 1$.

17. (a) Find 129 div 7 and 129 mod 7.

(b) Prove that $1.2 + 2.3 + 3.4 + ... + n(n+1) = \frac{n(n+1)(n+2)}{3}$.

UG–AS–1355	BMSSE–51

U.G. DEGREE EXAMINATION – JULY 2024.

Mathematical

Fifth Semester

MATHEMATICAL STATISTICS

Time : 3 hours Maximum marks : 70

SECTION A — (3 × 3 = 9 marks)

Answer any THREE questions out of Five questions in 100 words.

1. Write the merits of Arithmetic mean

2. Write the formula for correlation and regression

3. One card is drawn from a standard pack of 52. What is the probability that it is either a king or queen.

4. Statement of Central Limit Theorem

5. Write the Uses of X^2 test.

SECTION B — (3 × 7 = 21 marks)

Answer any THREE questions out of Five questions in 200 words.

6. Find the median for the following frequency distribution.

Daily wages	Less than 200	200-250	250-300	300-350	350-400	400 above
No. of Workers	5	15	20	30	20	8

7. Calculate Spearman rank Correlation coefficient for the following data.

X	53	98	95	81	75	65	59	55	58	63
Y	47	25	32	37	30	40	39	45	7	8

8. If about the origin the first three moments are 3, 24, 76 show that about the value 2 the first three moments are l, 14, –40.

9. A random sample of 200 tins of coconut oil gave an average weight of 4.95 kgs with a standard deviation of 0.21 kg. Do we accept the hypothesis of net weight 5gs per tin at 1 percent level.

10. Explain the significance of F-test for testing the population variance of two samples.

SECTION C — (4 × 10 = 40 marks)

Answer any FOUR questions out of Seven questions in 500 words.

11. (a) Calculate standard deviation from the following observations of marks of 5 students of a group 9, 12, 13, 15, 22.

(b) Calculate Mode from the following data.

Marks	No.of Students
0-10	3
10-20	5
20-30	7
30-40	10
40-50	12
50-60	15
60-70	12
70-80	6
80-90	2
90-100	8

12. Find the regression lines for the following data.

X	6	2	10	4	8
Y	9	11	5	8	7

13. (a) What is the minimum value of $P(-3 \leq x \leq 3)$ given that $\mu = 0, \sigma = -1$

(b) Write

(i) Definition of Probability density function.

(ii) Cumulative Distributive function.

(iii) Properties of Distribution function.

14. (a) Explain the steps involved in testing the large samples using two proportion for large samples.

(b) A person threw 10 dice 500 times and obtained 2560 times 4,5 or 6. Can this be attributed to fluctuations in sampling?

15. (a) In a sample of 8 observations the sum of the squared deviations of items from the mean was 94.5. In another sample of 10 observations the value was found to be 101.7. Test whether the difference in the variance is significant at 5 % level.

(b) Explain importance of Chi Square test in Statistics.

16. Find Mean, Median, Mode for the following data.

Mid Point	No.of Student
95	4
105	2
115	18
125	22
135	21
145	19
155	10
165	3
175	2

17. Find Karl Pearson Coefficient of correlation for the following data.

X	28	32	38	42	46	52	54	57	58	63
Y	0	1	3	4	2	5	4	6	7	8

UG–AS–1357	**BMSS–61**

U.G. DEGREE EXAMINATION — JULY 2024.

Mathematics

Sixth semester

REAL ANALYSIS – II

Time : 3 hours Maximum marks : 70

PART A — (3 × 3 = 9 marks)

Answer any THREE questions.

1. Prove that "arbitrary union of open sets is open."

2. Let the a continuous function from the compact metric space M_1 into the metric space M_2, then prove that the range $f(M_1)$ of f is also compact.

3. If $f \in R[a,b]$; $g \in R[a,b]$ and if $f(x) \leq g(x)$ almost everywhere $(a \leq x \leq b)$, then prove that $\int_a^b f \leq \int_a^b g$.

4. If the real-valued function f has a derivative at the point $c \in R^1$; then show that f is continuous at c.

5. State Cauchy criterion for uniform convergence of sequence of functions.

PART B — $(3 \times 7 = 21$ marks)

Answer any THREE questions.

6. If F_1 and F_2 are closed subsets of the metric space M, then prove that $F_1 \cup F_2$ is also closed.

7. If (M, ρ) be a complete metric space and A is a closed subset of M, then prove that (A, ρ) is also complete.

8. Let f be a hounded function on $[a, b]$, then show that every upper sum for f is greater than or equal to every lower sum for f : That is if σ and τ are any two sub division of $[a, b]$ then $U[f, \sigma] \geq L[f, \tau]$.

9. State and prove the First fundamental theorem.

10. Find the Taylor series about $x = 2$ for $f(x) = x^3 + 2x + 1 (-\infty < x < \infty)$.

PART C — ($4 \times 10 = 40$ marks)

Answer any FOUR questions.

11. Let (M_1, ρ_1) and (M_2, ρ_2) be metric spaces and let $f : M_1 \to M_2$, then show that f is continuous on M_1 if and only iff $f^{-1}(G)$ is open in M_1 whenever G is open in M_2.

12. State and prove Picard's Fixed Point Theorem.

13. Let f be a bounded function on the closed bounded interval $[a,b]$, then prove that $f \in R[a,b]$ if and only if, for each $\varepsilon > 0$; there exists subdivision σ of $[a,b]$ such that $U[f, \sigma] < L[f,\sigma] + \varepsilon$.

14. Prove that if f and g both have derivatives at $c \in R^1$ then so do $f+g; f-g; fg$ and we have $(f+g)'(c) = f'(c) + g'(c)$ $(f-g)'(c) = f'(c) - g'(c)$ $(fg)'(c) = f'(c)g(c) + g'(c)f(c)$.

    Further, if $g'(c) \neq 0$ then f/g has a derivative at c and $\left(\frac{f}{g}\right)' c = \frac{g(c)f'(c) - f(c)g'(c)}{[g(c)]^2}$.

15. State and prove Taylor's formula with Cauchy form of the remainder.

16. Prove that if $f \in R[a,b]$ and $a < c < b$; then $f \in R[a,c]$; $f \in R[c,b]$ and $\int_a^b f = \int_z^c f + \int_c^b f$.

17. Suppose f has a derivative at c and that g has a derivative at $f(c)$: Then prove that $\phi = g \circ f$ has a derivative at c and $\phi'(c) = g'(f(c))f'(c)$.

UG–AS–1358	**BMSS–62**

U.G. DEGREE EXAMINATION –
JULY 2024.

Mathematics

Sixth Semester

MECHANICS

Time : 3 hours Maximum marks : 70

SECTION A — (3 × 3 = 9 marks)

Answer any THREE questions.

1. State newton's laws of motion
2. Define
   (a) Couple,
   (b) Virtual work.
3. Define
   (a) Kinetic energy,
   (b) Potential energy.
4. Write the Maximum height and Horizontal range of a projectile.

5. Define Central force.

SECTION B — ($3 \times 7 = 21$ marks)

Answer any THREE questions.

6. The magnitude of the resultant of two given forces P, Q is R. If Q is doubled, then R is doubled. If Q is reversed, then also R is doubled. Show that $P: Q: R = \sqrt{2}: \sqrt{3}: \sqrt{2}$.

7. Prove that a system of coplanar forces reduces either to a single force or to a couple.

8. Show that, when a particle is subject to the action of conservative forces,

   (a) the increase in K.E. in an interval is equal to the work done in that interval and

   (b) the sum of the K.E and P.E. is a constant with respect to time.

9. Verify, in the case of a projectile, $K.E+P.E=a$ constant

10. A small ring threaded to a smooth vertical circular wire, is projected from a lowest point. Find its motion.

SECTION C — ($4 \times 10 = 40$ marks)

Answer any FOUR questions..

11. Suppose a particle of weight W lying on a rough plane inclined at an angle to the horizontal is subjected to a force P along the plane in the upward direction. If the equilibrium is limiting, to find P.

12. Show that the forces AB, CD, EF acting respectively at A, C, E of a regular hexagon $ABCDEF$, are equivalent to a couple of moment equal to the area of the hexagon.

13. (a) Show that the resultant of two simple harmonic motions of same period along the same straight line is also simple harmonic with the same period.

    (b) Show that the resultant motion of two simple harmonic motions of same period along two perpendicular lines, is along an ellipse.

14. Show that the speed of a projectile at any point on its path equals the speed of a particle acquired by it in falling from the directrix to the point.

15. A particle slides on a smooth sphere starting from rest at the highest point. Find the point where the particle leaves the sphere.

16. State and prove LAMI's theorem.

17. A particle is projected from a point 0 on the ground with a velocity u inclined to the horizontal at an angle α. It hits the ground at A. To find

(a) Maximum height H attained by the particle.

(b) Time taken to attain the maximum height.

(c) Time of flight (from 0 to A).

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UG-AS–1359	BMSS-63

U.G. DEGREE EXAMINATION — JULY 2024.

Mathematics

Sixth Semester

COMPLEX ANALYSIS

Time : 3 hours Maximum marks : 70

SECTION A — ($3 \times 3 = 9$ marks)

Answer any THREE questions.

1. Prove that the log z analytic everywhere except at $z = 0$.

2. Write the properties of the complex exponential function.

3. Evaluate $\int_C \frac{e^{2z}}{z^4} dz$ where $c : |z| = 1$.

4. State the Laurent series.

5. Define isolated singular point.

SECTION B — (3 × 7 = 21 marks)

Answer any THREE questions.

6. Examine whether the function $f(z) = e^{z}(\cos y - i \sin y)$ is analytic or not.

7. Find the bilinear transformation which transform that maps the points $z_1 = \infty$, $z_2 = i$, $z_3 = 0$ onto $w_1 = 0$, $w_2 = i$, $w_3 = \infty$.

8. Prove that the function $f(z) = ze^{z} - z$ has a zero of order 2 at origin.

9. Find the Taylor's expansion of $f(z) = e^{2z}$ at $z = 2i$.

10. Determine the zeros for $h(z) = z^{7} - 2z^{3} + 7$ inside the disk $|z| = 2$.

SECTION C — (4 × 10 = 40 marks)

Answer any FOUR questions.

11. A complex function $f(z)$ can be written as $w = f(z) = u(x, y) + iv(x, y)$. Prove that $f(z)$ is analytic if and only if the first derivative satisfy two Cauchy Riemann equation $u_x = v_y$ and $u_y = -v_x$.

12. State and prove Schwarz Lemma.

13. If a function $f(z)$ is analytic inside and on a circle with center z_0 then prove that for any point lying with in the circle $f(z) = \sum_{n=0}^{\infty} a_n (z - z_n)^n$ where $a_n = \dfrac{f^n(z_0)}{n!}$.

14. Use Cauchy integral formula or theorem, to evaluate $\int_z \dfrac{\sin \pi z + \cos \pi z}{(z-1)(z-2)} dz$ where z is a circle $|z| = \dfrac{3}{2}$.

15. Show that $\int_{-\infty}^{\infty} \dfrac{\cos 3x}{(x^2+1)} dx = \dfrac{2\pi}{e^3}$.

16. State and derive Cauchy Riemann Equations in polar form.

17. Expand $f(z) = \dfrac{1}{(z+1)(x+3)}$ in a Laurent's series valid for the regions

(a) $|z| = 1$

(b) $0 < |z+1| < 2$.

UG–AS–1360	BMSSE–61

U.G. DEGREE EXAMINATION — JULY 2024.

Sixth Semester

OPERATIONS RESEARCH

Time : 3 hours Maximum marks : 70

PART A — ($3 \times 3 = 9$ marks)

Answer any THREE questions out of five questions in 100 words

All questions carry equal marks.

1. What is meant by LPP?

2. Define basic feasible solution.

3. What is total elapsed time?

4. Define arrival time in queueing system.

5. Define critical path.

PART B — $(3 \times 7 = 21$ marks)

Answer any THREE questions out of five questions in 200 words.

6. Solve the following LPP by graphical method. Maximize $z = 30x_1 + 20x_2$

Subject to the constraints

$2x_1 + x_2 \leq 800, x_1 + 2x_2 \leq 1000$ and $x_1, x_2 \geq 0$.

7. Solve the assignment problem for assigning five jobs to five persons.

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

8. Solve the following game by dominance property

(Player B)

$$\text{(Player A)} \begin{pmatrix} 1 & 7 & 2 \\ 6 & 2 & 7 \\ 5 & 1 & 6 \end{pmatrix}$$

9. Explain briefly the characteristic of queuing process.

10. Draw the network for the project whose activity are given below and compute the total float, free float, independent float of each activity and hence determine the critical path and project duration.

Activity	1-2	1-3	2-4	3-4	3-5	4-5	4-6	5-6
Duration	6	5	10	3	4	6	2	9

PART C — (4 × 10 = 40 marks)

Answer any FOUR questions out of Seven questions in 500 words.

All questions carry equal marks.

11. Solve the following LPP by simplex method.

Minimize $Z = 4x_1 + 3x_2$

Subject to the constraints

$2x_1 + x_2 \geq 10,\ 3x_1 - 2x_2 \geq -6,\quad x_1 + x_2 \geq 6$ and $x_1,\ x_2 \geq 0$.

12. Solve the transportation problem by using VAM and find the optimal Solution.

	1	2	3	4	Supply
I	21	16	25	13	11
II	17	18	14	23	13
III	32	27	18	41	19
Demand	6	10	12	15	

13. Find the sequence that minimizes the total elapsed time required to complete the following tasks. Also find the idle time on each machine.

Jobs	A	B	C	D	E	F	G
Machine M1	3	12	15	6	10	11	9
Machine M2	8	10	10	6	12	1	3

14. At a one-man barber shop, customers arrive according to Poisson distribution with a mean arrival rate of 5 per hour and his hair cutting time was exponentially distributed with an average hair cutting 10 minutes. It is assumed that because of his excellent reputation, customers were always willing to wait. Calculate the following:

(a) Average number of customers in the shop and the average number of customers waiting for a hair cut.

(b) The percentage of time an arrival can walk right in without having to wait.

(c) The percentage of customers who have to wait prior to getting into the barber's chair.

15. A project schedule has the following characteristics. Activity Expected duration (weeks)

	Expected duration (Weeks)		
Activity	Optimistic	Most likely	Pessimistic
1-2	3	3	3
2-3	3	6	9
2-4	2	4	6
3-5	4	6	8
4-6	4	6	8
5-6	0	0	0
5-7	3	4	5
6-7	2	5	8

(a) Draw the project network and trace all the possible paths from it.

(b) Determine the critical path and the expected project time.

(c) What is the probability that will be completed in 20 weeks?

16. Solve the following 2×5 game by graphical method.

$$\text{(Player A)} \overset{\text{(Player B)}}{\begin{pmatrix} 2 & -1 & 5 & -2 & 6 \\ -2 & 4 & -3 & 1 & 0 \end{pmatrix}}$$

17. Describe briefly the two phase method of solving a LPP with artificial variables.
