Total No. of Printed Pages:02

SUBJECT CODE NO:- L-2021
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. F.Y. (Sem-II) Examination March/April 2019
Mathematics MAT – 201
(Integral Calculus)

[Time: 1:30 Hours] **[Max.Marks: 50]**

Please check whether you have got the right question paper.

N.B
i. Attempt all questions.
ii. Figure to the right indicate full marks.

Q.1 A) Attempt any one 08

a) Obtain a reduction formula for $\int x^m(\log x)^n dx$ and apply it to evaluate $\int x^4(\log x)^3 dx$.

b) Evaluate the definite integral $\int_0^{\pi/2} \sin^n x\, dx$, where n is positive integer. Hence evaluate $\int_0^{\pi/2} \sin^7 x\, dx$

B) Attempt any one 07

c) Evaluate $\int \frac{dx}{(x+1)^2(x^2+1)}$

d) Evaluate $\int \frac{x^2 dx}{(x+1)(x-2)(x+3)}$

Q.2 A) Attempt any one 08

a) Evaluate $\int_a^b x^2 dx$ as the limit of sum.

b) Show that the area of a loop of the curve $x^4 = a^2(x^2 - y^2)$ is $2a^2/3$.

B) Attempt any one 07

c) Show that the length of the loop of the curve $3ay^2 = x(x-a)^2$ is $4a/\sqrt{3}$

d) Find the volume of the solid obtained by revolving one arc of the cycloid $x = a(\theta + \sin\theta)\,, y = a(1 + \cos\theta)\ about\ X - axis$.

Q.3 A) Attempt any one 05

a) Prove that the necessary and sufficient condition for a continuous vector point function to be irrotational in a simply connected region R is that it is the gradient of a scalar point function.

b) If $\vec{F}$ is any continuously differentiable vector point function and S is a surface bounded by a curve C, then prove that. $\int_c \vec{F}\,.\,d\vec{r} = \int_s curl\,\vec{F}\,.\vec{n}\,ds.$
Where the unit normal vector $\vec{n}$ at any point of S is drawn in the sense in which a right handed screw would move when rotated in the sense of description of C.

B) Attempt any one 05

c) Show that $\frac{1}{3}\int_s \vec{r}.\,d\vec{a} = v,$ where V is the volume enclosed by the surface S.

d) Verify Stoke's theorem for the function $\vec{F} = x(x_{\bar{i}} + y_{\bar{j}})$, integrated round the square in the plane z=0 whose sides are along the lines $x = 0, y = 0, x = a, y = a$.

Q.4 Choose the correct alternative and fill in the blanks. 10

1) $\int \frac{dx}{5-2x} =$ ____
   a. $-\frac{1}{2}\log(5-2x)$
   b. $\frac{1}{2}\log(5-2x)$
   c. $\log(5-2x)$
   d. $-\log(5-2x)$

2) $\int \sin^3 x dx =$ ______
   a. $\cos x - \frac{\cos^3 x}{3}$
   b. $\cos x + \frac{\cos^3 x}{3}$
   c. $-\cos x - \frac{\cos^3 x}{3}$
   d. $-\cos x + \frac{\cos^3 x}{3}$

3) The length of the arc of the curve $r = f(\theta)$ include between two points whose vectorial angles are α, β is ______
   a. $\int_\alpha^\beta [\sqrt{f^2(\theta) - f'^2(\theta)}\,]d\theta$
   b. $\int_\alpha^\beta [\sqrt{f^2(\theta) + f'^2(\theta)}]d\theta$
   c. $\int_\alpha^\beta [\sqrt{f^2(\theta) - f'(\theta)}]\,d\theta$
   d. $\int_\alpha^\beta [\sqrt{f^2(\theta) + f'(\theta)}]d\theta$

4) A vector point function is said to be irrotational in a region, if its circulation along every closed curve in a region is ______
   a. One
   b. Zero
   c. Infinity
   d. None of these

5) Area bounded by a simple closed curve C is _______
   a. $\oint_c (x\,dy + y\,dx)$
   b. $\oint_c (x\,dy - y\,dx)$
   c. $\frac{1}{2}\oint_c (x\,dy - y\,dx)$
   d. $\frac{1}{2}\oint_c (x\,dy + y\,dx)$

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SUBJECT CODE NO:- L-2022
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. F.Y. (Sem-II) Examination March/April 2019
Mathematics MAT - 202
(Geometry)

[Time: 1:30 Hours] **[Max.Marks: 50]**

Please check whether you have got the right question paper.

N.B
i. Attempt all questions.
ii. Figure to the right indicate full marks.

Q.1 A) Attempt any one — 08

a) Define the right circular cylinder and find the equation of the right circular cylinder whose axis is the line $\frac{x-\alpha}{l}=\frac{y-\beta}{m}=\frac{z-\gamma}{n}$, and whose radius is r.

b) Find the condition that the two given straight lines $\frac{x-x_1}{l_1}=\frac{y-y_1}{m_1}=\frac{z-z_1}{n_1}$, $\frac{x-x_2}{l_2}=\frac{y-y_2}{m_2}=\frac{z-2}{n_2}$ are coplanar .

B) Attempt any one. — 07

c) Find the equation of the planes bisecting the angles between the planes $x+2y+2z-3=0$, $3x+4y+12z+1=0$ and specify the one which bisects the acute angle.

d) Find the co-ordinates of the point of intersection of the line $\frac{x+1}{1}=\frac{y+3}{3}=\frac{z-2}{-2}$ with the plane $3x+4y+5z=5$.

Q.2 A) Attempt any one — 08

a) Transform the equations $ax+by+cz+d=0$, $a_1x+b_1y+c_1z+d_1=0$ of a line to the symmetrical form.

b) Find the points of intersection of a sphere and a line $x^2+y^2+z^2+2ux+2vy+2wz+d=0$, and $\frac{x-\alpha}{l}=\frac{y-\beta}{m}=\frac{z-\gamma}{n}$ be the equations of a sphere and a line respectively.

B) Attempt any one — 07

c) Obtain the line drawn through the point (1, 0, -1) and intersecting the lines

$$x=2y=2z\,;3x+4y=1,4x+5z=2$$

d) Find the two tangent planes to the sphere $x^2+y^2+z^2-4x+2y-6z+5=0$ which are parallel to the plane $2x+2y=z$

Q.3 A) Attempt any one 05

a) Find the perpendicular distance of the point $p(x_1, y_1, z_1)$ from the plane $lx + my + nz = p$

b) Find the equation of the tangent plane of the tangent line $\frac{x-\alpha}{l} = \frac{y-\beta}{m} = \frac{z-\gamma}{n}$ passing through the point (α, β, γ) of the surface $ax^2 + by^2 + cz^2 = 1$

B) Attempt any one 05

c) Find the equation of the right circular cone with its vertex at the origin, axis along z-axis and semi- vertical angle α.

d) Show that the plane $3x + 12y - 6z - 17 = 0$ touches the conicoid $3x^2 - 6y^2 + 9z^2 + 17 = 0$, and find the point of contact.

Q.4 Choose the correct alternatives and fill in the blanks. 10

1) The angle between the planes $2x - y + z = 6, x + y + 2z = 7$ is
   a. $\cos^{-1}(4/\sqrt{21})$ b. $\pi/3$
   c. $\pi/4$ d. $\pi/2$

2) Any point on the line $\frac{x-\alpha}{l} = \frac{y-\beta}{m} = \frac{z-\gamma}{n}$ is given by
   a. (α, β, γ) b. $(l\alpha, m\beta, n\gamma)$
   c. $(\alpha + lr, \beta + mr, \gamma + nr)$ d. None of these

3) Center of sphere $x^2 + y^2 - z^2 - 4x + 6y - 8z + 8 = 0$ will be
   a. (2, -3, 4) b. (2, 3, 4)
   c. (-2, -3, -4) d. (1, 2, 3)

4) A great circle is the section of a sphere by a plane passing through the _____ of the sphere.
   a. Cone b. centre c. chord d. centroid

5) the condition that the plane $lx + my + nz = p$ may touch the conicoid $ax^2 + by + cz^2 = 1$ is
   a. $\frac{l}{a} + \frac{m}{b} + \frac{n}{c} = P$ b. $\frac{l^2}{a} + \frac{m^2}{b} + \frac{n^2}{c} = P^2$
   c. $\frac{l}{a^2} + \frac{m}{b^2} + \frac{n}{c^2} = P^2$ d. $\frac{l^2}{a} + \frac{m^2}{b} + \frac{n^2}{c} = P$

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SUBJECT CODE NO:- L-2025
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. T.Y. (Sem-VI) Examination March/April 2019
Mathematics MAT-601
Real Analysis-II

[Time: 1:30 Hours] **[Max.Marks: 50]**

Please check whether you have got the right question paper.

N.B
i. All questions are compulsory.
ii. Figures to the right indicate full marks.

Q.1 A) Attempt any one: 08

a) If G_1 and G_2 are open subset of the metric space M, then prove that $G_1 \cap G_2$ is also open.

b) If the subset A of the metric space (M, ρ) is totally bounded, then prove that A is bounded.

B) Attempt any one : 07

c) If l^1 is the class of all sequence $\{S_n\}_{n=1}^{\infty}$ of real number such that $\sum_{n=1}^{\infty}|S_n| < \infty$, and if $s = \{S_n\}_{n=1}^{\infty}$ and $t = \{t_n\}_{n=1}^{\infty}$ are in l^1, then how that $\rho(s,t) = \sum_{n=1}^{\infty}|s_n - t_n|$ defines metric for l^1

d) If A and B are closed subsets of R^1, then prove that $A \times B$ is closed of R^2.

Q.2 A) Attempt any one: 08

a) If f is continuous on the closed bounded interval $[a, b]$ and if

$$F(x) = \int_a^x f(t)dt \text{ for all } x \in [a, b] \text{ then prove that } F'(x) = f(x).$$

b) If $f(x)$ is Riemann integrable in every interval and is periodic with period 2π, then prove that.

$$\int_{-\pi}^{\pi} f(x)dx = \int_{-\pi}^{\pi} f(a + x)dx \quad \text{where } a \text{ is any number}$$

B) Attempt any one: 07

c) Show that:

$$\lim_{n\to\infty} \frac{1}{n}\left[\left(\frac{1}{n}\right)^2 + \left(\frac{2}{n}\right)^2 + \cdots + \left(\frac{n}{n}\right)^2\right] = \frac{1}{3}$$

d) Obtain the Fourier series expansion of $f(x) = x \sin x$ in $[-\pi, \pi]$.

Q.3 A) Attempt any one: 05

a) If (M, ρ) is a metric space and if $\{s_n\}_{n=1}^{\infty}$ is a convergent sequence of points of M, then prove that $\{s_n\}_{n=1}^{\infty}$ is Cauchy sequence.

b) If each of subset $E_1, E_2, \ldots of\ R^1$ is of measure zero, then prove that $\cup_{n=1}^{\infty} E_n$ is also of measure zero.

B) Attempt any one: 05

c) If f is the function from R^2 onto R^1 defined by $f(x, y) = x\ for\ all\ (x, y) \in R^2$, then show that f is continuous on R^2.

d) If $f(x) = x, for\ 0 \le x \le 1\ , if \sigma$ is the subdivision $\left\{0, \frac{1}{3}, \frac{2}{3}, 1\right\}$ of [0, 1], then find $U[f, \sigma]$ and $L[f, \sigma]$.

Q.4 Choose the correct alternative and rewrite the sentence. 10

1) In a metric space (M, ρ) for all $x, y, z\ \in M$ the triangle inequality is ________
   a) $\rho(x, y) \le \rho(x, z) + \rho(z, y)$
   b) $\rho(x, y) \ge \rho(x, z) + \rho(z, y)$
   c) $\rho(x, z) \le \rho(x, z) + \rho(y, z)$
   d) $\rho(x, y) \le \rho(x, z) - \rho(z, y)$

2) Every singleton set in a discrete metric space R_d is ______
   a. Open
   b. Closed
   c. Both open and closed
   d. Half open closed

3) The open ball $B\left[0; \frac{1}{2}\right]$ in R^1 is ______
   a. (0, 1)
   b. $\left[0, \frac{1}{2}\right]$
   c. [0, 1]
   d. $\left(-\frac{1}{2}, \frac{1}{2}\right)$

4) If $f\ \in \Re[a, b]\ and\ \ if\ F'(x) = f(x) for\ all\ x \in [a, b] then\ \int_a^b f(x)dx =$ ____
   a. $F(b) + F(a)$
   b. $F(b) - F(a)$
   c. $f(b) - f(a)$
   d. $f(b) + f(a)$

5) For all $n = 0, 1, 2, \ldots,, \int_{-\pi}^{\pi} \sin^2 nx dx =$ ____
   a. $-\pi$
   b. π
   c. $-\frac{\pi}{2}$
   d. $\frac{\pi}{2}$

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SUBJECT CODE NO:- L-2026
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. T.Y. (Sem-VI) Examination March/April 2019
Mathematics MAT - 602
Abstract Algebra - II

[Time: 1:30 Hours] **[Max.Marks: 50]**

Please check whether you have got the right question paper.

N.B
i. All question are compulsory.
ii. Figure to the right indicate full marks.

Q.1 A) Attempt any one: 08

a) If T is homomorphism of a vector space U onto a vector space V with kernel W, then prove that V is isomorphic to U / W.

b) If S and T are subsets of a vector space V, then prove that:
i) $S \subseteq T \; implies \; that \; L(S) \subseteq L(T),$
ii) $L(S \cup T) = L(S) + L(T)$

B) Attempt any one: 07

c) If U and W are two subspaces of a vector space V, then prove that
$$U + W = \{v \in V \mid v = u + w, u \in U, w \in W\}$$
is a subspace of V.

d) If T is an isomorphism of a vector space V onto a vector space W, then prove that T maps a basis of V onto a basis of W.

Q.2 A) Attempt any one: 08

a) If V is an inner product space and if $u, v \in V$, then prove that $|(u,v)| \leq ||u||\,||v||$.

b) If V is finite-dimensional vector space over F, then prove that the mapping $\psi : V \to \hat{\hat{V}} \; given \; by \; \psi(v) = T_v \; for \; every \; v \in V$, is an isomorphism of V onto $\hat{\hat{V}}$.

B) Attempt any one: 07

c) In $F^{(2)}$, for
$$u = (\alpha_1, \alpha_2) \; and \; v = (\beta_1, \beta_2), define \; (u,v) = 2\alpha_1\overline{\beta_1} + \alpha_1\overline{\beta_2} + \alpha_2\overline{\beta_1} + \alpha_2\overline{\beta_2}$$
Then show that this define an inner product on $F^{(2)}$.

d) Show that every abelian group G is a module over the ring of integers.

Q.3 A) Attempt any one: 05

a) If W is subspace of a vector space V, then prove that $W^{\perp}$ is subspace of V.

b) If V is a vector space over a field F, then for $v \in V, \alpha \in F$ prove that
i) $(-\alpha)v = -(\alpha v),$
ii) $if \; v \neq 0 \; then \; \alpha v = 0 \Rightarrow \alpha = 0$

B) Attempt any one: 05

c) If V is an inner product space over R, the set of real numbers, then prove the parallelogram law. $||u+v||^2 + ||u-v||^2 = 2\left(||u||^2 + ||v||^2\right)$

d) Show that in $F^{(3)}$ the vectors $(1,0,0), (0,1,0), (0,0,1)$ are linearly independent.

Q.4 Choose the correct alternative and rewrite the sentence. 10

1) If W is a subspace of a vector space V such that $dimV = 5\ and\ dimW = 2, then$ dim $A(W) =$ ______
   a. 5   b. 3   c. 7   d. 2

2) The norm of the vector (0, 3, -4) is ______
   a. 0   b. -3   c. 5   d. -2

3) If V is an inner product space over a complex field F and if $(\alpha u, v) = \alpha(u,v), then\ (u, \alpha v) =$ __for all $u, v \in V\ and\ \alpha \epsilon F$.
   a. $\alpha(u,v)$ b. $(\alpha u, v)$ c. $(\alpha u, \alpha v)$ d. $\bar{\alpha}(u,v)$

4) If U and V are vector spaces over a field F, if $T: U \to V$ is a homomorphism, then the kernel of T is given by ker(T)=_________
   a) $\{u \epsilon V | T(u) = 0\}$
   b) $\{u \epsilon V | T(u) = v\}$
   c) $\{u \epsilon U | T(u) = u\}$
   d) $\{u \epsilon U | T(u) = 0\}$

5) If W is a subspace of a vector space V over the field F and if V/W is quotient space of W in V, then scalar multiplication on V/W is defined as $\alpha(u+W) =$ ____, for all $u \epsilon V, \alpha \epsilon F$.
   a. $\alpha u + \alpha W$ b. $\alpha u + W$
   c. $u + \alpha W$ d. $u + W$

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SUBJECT CODE NO:- L-2029
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. S.Y. (Sem-IV) Examination March/April 2019
Mathematics MAT - 401
Numerical Methods

[Time: 1:30 Hours] **[Max.Marks: 50]**

Please check whether you have got the right question paper.

N.B
i) Attempt all questions.
ii) Figure to the right indicate full marks.
iii) Use of non-programmable calculator and logarithmic table is allowed.

Q.1 A) Attempt any one: 08

a) Derive Newton – Raphson method to find root of an equation $f(x) = 0$. Show that the method has quadratic convergence.

b) Derive Newton/s backward interpolation formula.

B) Attempt any one: 07

c) Find the cubic polynomial which takes the values.
$y(0) = 1,\ y(1) = 0,\quad y(2) = 1\ and\ y(3) = 10$
Also find $y(4)$.

d) Find a double root of the equation $f(x) = x^3 - x^2 - x + 1 = 0,\ x_0 = 0$
By generalized Newton's method.

Q.2 A) Attempt one: 08

a) Discuss Hermite's interpolation formula in detail.

b) Explain the method of fitting the data points $(x_i, y_i),\quad i = 1,2,\dots,m$ to a polynomial of the n^{th} degree.

B) Attempt any one: 07

c) Fit a straight line $y = a_0 + a_1 x$ to the data points.

x:	0	1.0	2.0
y:	1.0	6.0	17.0

d) Solve the following system of equations.
$2x + 3y + z = 9$
$x + 2y + 3z = 6$
$3x + y + 2z = 8$
By the factorization method.

Q.3 A) Attempt any one: 05

a) Discuss QR method to find the Eigen values.

b) Explain Picard's method of successive approximations.

B) Attempt any one: 05

c) Use Runge – Kutta second – order method to solve.
$y' = y - x \quad , \qquad y(0) = 2$
Find $y(0.1)$ and $y(0.2)$ correct to four decimal places.

d) Solve the system
$2x + y + z = 10$
$3x + 2y + 3z = 18$
$x + 4y + 9z = 16$
Using Gauss – Jordan method.

Q.4 Choose the correct alternative and rewrite the sentence. 10

i) Newton – Raphson method converges _________ than Regula – falsi method.
a) Slower b) Faster c) Monotonically d) Slower and faster

ii) The fourth difference of
$\frac{1}{2}x^4 + x^3 + x^2 + x + 2$ is ……….
a) 24 h^4 b) h^4 c) 12 h^4 d) 4 h^4

iii) Lagrange polynomial of degree n passes through _______ points.
a) $n + 1$ b) n c) $n - 1$ d) $(n + 1)^2$

iv) The Chebyshev polynomial of degree 2 is _______
a) x b) x^2 c) $2x^2+1$ d) $2x^2-1$

v) The initial value problem consists of ________ and initial conditions.
a) Differential equation b) Solution of differential equation
c) Boundary conditions d) Integral equation

Total No. of Printed Pages:02

SUBJECT CODE NO:- L-2030
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. S.Y. (Sem-IV) Examination March/April 2019
Mathematics MAT - 402
Partial Differential Equation

[Time: 1:30 Hours] **[Max.Marks:50]**

Please check whether you have got the right question paper.

N.B
i. All questions are compulsory.
ii. Figures to the right indicate full marks.

Q.1 A) Attempt any one: 08
a) Explain the method to integrate the equation of the form $f(z,p,q) = 0$.
b) Discuss the method of solving Lagrange's linear partial differential equation.

B) Attempt any one: 07
c) Find the complete integral of $z^2(p^2+q^2) = x^2+y^2$
d) Solve $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z} = au + \frac{xy}{z}$

Q.2 A) Attempt any one: 08
a) Obtain the solution of the equation $Rr + Ss + Tt = V$ by Monge's method.
b) Explain the method of solution of $Rr + Ss + Tt + f(x,y,z,p,q) = 0$ when $S^2 - 4RT > 0$.

B) Attempt any one: 07
a) Apply Charpit's method to solve $z = pq$.
b) Solve $r = a^2 t$.

Q.3 A) Attempt any one: 05
a) Explain charpits method to solve partial differential equation.
b) Show that $z = \phi_1(y+m_1x) + \phi_2(y+m_2x) + \cdots + \phi_n(y+m_nx)$ is a general solution of the equation $F(D,D')z = 0$.

B) Attempt any one. 05
a) Solve $(D^3 - D'^3)z = x^3y^3$
b) Solve $p + r + s = 1$.

Q.4 Choose the current alternative and rewrite the sentence. 10
i) The function $\phi(x,y,z,a,b)$ is a complete integral of the partial differential equation________.
a) $\phi(x,y,z) = 0$ b) $f(x,y,z,p,q) = 0$
c) $f(x,y,z) = 0$ d) $\phi(a,b,p,q) = 0$

ii) The auxiliary equations for the equation $pcos\,(x+y)+q\,\sin(x+y)=z$ are _______.

a) $dx=dy=dz$ b) $\frac{dx}{p}=\frac{dy}{q}=\frac{dz}{z}$

c) $\frac{dx}{\cos(x+y)}=\frac{dy}{\sin(x+y)}=\frac{dz}{z}$ d) $\frac{dx}{\sin(x+y)}=\frac{dy}{z}=\frac{dz}{\perp}$

iii) The singular integral does not exists for the partial differential equation of the form ____.

a) $f(a,pb)=0$ b) $f(a,p)=0$

c) $f(b,q)=0$ d) $f(p,q)=0$

iv) The solution of the partial differential equation $(D-mD'-K)Z=0$ is given by ______.

a) $z=e^{kx}\phi(y+mx)$ b) $z=e^{x}\phi(y+mx)$

c) $z=e^{-kx}\phi(y+mx)$ d) $z=e^{-x}\phi(y+mx)$

v) The general solution of the equation $F(D,D')z=f(x,y)$ consists of ________.

a) Complementary function and singular integral
b) Complementary function and particular integral
c) Particular integral and singular integral
d) Particular integral and complete integral.

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SUBJECT CODE NO:- L-2047
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. T.Y (Sem-VI) Examination March/April 2019
Mathematics MAT
1) Mathematical Statistics-II - 603

[Time: 1:30 Hours] **[Max.Marks: 50]**

Please check whether you have got the right question paper.

N.B
1) All questions are compulsory.
2) Figures to the right indicate full marks.

Q.1 A) Attempt any one: 08

a) If X is a random variable, then prove that:

$$V(aX + b) = a^2 V(X)$$

Where a and b are constants.

b) If X and Y are two independent random variables, then prove that covariance between them is zero.

B) Attempt any one: 07

c) What is the expectation of the number of the number of failures preceding the first success in an infinite series of independent trials with constant probability p of success in each trial?

d) Let variate X have the distribution

$$P(X = 0) = P(X = 2) = p;$$
$$P(X = 1) = 1 - 2p \quad for\ 0 \le p \le 1/2$$

For what p is the var (X) a maximum?

Q.2 A) Attempt any one: 08

a) Obtain the moment generating function of the Binomial distribution and hence find $\mu_1, \mu_2, \mu_3\ and\ \mu_4$.

b) Find the recurrence relation for the first four moments of Poisson Distribution.

B) Attempt any one: 07

c) A box contains 'a' white and 'b' black balls 'c' balls are drawn. Find the expected value of the number of white balls drawn.

d) Show that in a Poisson Distribution with unit mean, mean deviation about mean is (2/e) times of the standard deviation.

Q.3 A) Attempt any one: 05

a) Obtain the cumulant generating function of normal distribution and hence find β_1 and β_2.

b) Define geometric distribution and hence find mean of geometric distribution.

B) Attempt any one: 05

c) A poisson distribution has a double mode at $x = 1$ and $x = 2$. What is the probability that x will have one or the other of these two values?

d) If X is uniformly distributed with mean 1 and variance 4/3. Find $P(X < 0)$.

Q.4 Choose the correct alternative and rewrite the sentence: 10

1) For two random variable X and Y the relation $E(X.Y) = E(X).E(Y)$ ... .
   - a) If X and Y are identical
   - b) For All X and Y
   - c) If X and Y are statistically independent
   - d) None of these

2) The mean and variance of Binomial distribution are same if _______
   - a) $p < q$ b) $p > q$ c) $p = q$ d) $np = npq$

3) The moment generating function of gamma distribution is _______
   - a) $(1+t)^{+\lambda}$ b) $(1-t)^{\lambda}$ c) $(1-t)^{-\lambda}$ d) $(1+t)^{-\lambda}$

4) Correlation co – efficient is _____ of change of scale.
   - a) Dependent
   - b) Independent
   - c) Independent and dependent
   - d) None of these

5) β_2 for the normal distribution is _______
   - a) 1 b) 3 c) 0 d) 4/5

OR

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SUBJECT CODE NO:- L-2047
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. T.Y (Sem-VI) Examination March/April 2019
Mathematics MAT
2) Ordinary Differential Equation-II – 604

[Time: 1:30 Hours] **[Max.Marks: 50]**

Please check whether you have got the right question paper.

N.B 1) All questions are compulsory.
2) Figures to the right indicate full marks.

Q.1 A) Attempt any one: 08

a) Suppose that $\Phi_1, \Phi_2, \ldots, \Phi_n$ are n solutions of
$L(y) = y^{(n)} + a_1(x)y^{(n-1)} + \cdots + a_n(x)y = 0.$
If Φ is any solution of $L(y) = 0$ on I, then prove that there are n constants $c_1, c_2, \ldots, c_n$ such that $\Phi = c_1\Phi_1 + c_2\Phi_2 + \cdots + c_n\Phi_n$.

b) Let b be continuous on an interval I, and let $\Phi_1, \Phi_2, \ldots, \Phi_n$ be basis for the solution of $L(y) = y^{(n)} + a_1(x)y^{(n-1)} + \cdots + a_n(x)y = 0$ on I. prove that every solution ψ of $L(y) = b(x)$ can be written as $\psi = \psi_p + c_1\Phi_1 + c_2\Phi_2 + \cdots + c_n\Phi_n$. Where ψ_p is a particular solution of $L(y) = b(x)$. A particular solution ψ_p is given by

$$\psi_p(x) = \sum_{k=1}^{n} \Phi_{k(x)} \int_{x_0}^{x} \frac{W_k(t)b(t)}{W(\Phi_1,\ldots,\Phi_n)(t)} dt$$

B) Attempt any one: 07

c) Consider the equation
$y" + \frac{1}{x}y' - \frac{1}{x^2}y = 0, for\ x > 0$

i) Show that there is a solution of the form x^r, where r is constant.

ii) Find two linearly independent solutions for $x > o$ and prove that they are linearly independent.

iii) Find the two solutions Φ_1, Φ_2 satisfying

$$\Phi_1(1) = 1\ , \Phi_2(1) = 0$$
$$\Phi_1'(1) = 0\ \ , \Phi_2'(1) = 1$$

d) One solution of
$x^2y" - 2y = 0$ on $0 < x < \infty$ is $\Phi_1(x) = x^2$. Find all solutions of
$x^2y" - 2y = 2x - 1$ on $0 < x < \infty$

Q.2 A) Attempt any one: 08

a) Suppose that Φ_1 is a solution of
$L(y) = y^{(n)} + a_1(x)y^{(n-1)} + \cdots + a_n(x)y = 0$
On an interval I and suppose that $\Phi_1(x) \neq 0$ on I. if $\vartheta_2, \vartheta_3, \ldots, \vartheta_n$ is any basis on I for the solutions of linear equation.

$$\Phi_1\vartheta^{(n-1)} + \cdots + \left[n\Phi_1^{(n-1)} + (n-1)\Phi_1^{(n-2)} + \cdots + a_{n-1}\Phi_1\right]\vartheta = 0$$

Of order $n-1$, and if $\vartheta_k = u_k'$ for $R = 2,3,\dots,n$
Then prove that $\Phi_1, u_2\Phi_1, \dots, u_n\Phi_n$ is a basis for the solutions of $L(y) = 0$ on I.

b) If $\Phi_1, \Phi_2, \dots, \Phi_n$ are n solutions of
$L(y) = y^{(n)} + a_1(x)y^{(n-1)} + \cdots + a_n(x)y = 0$ on I. Prove that they are linearly independent there if and only if,
$W(\Phi_1, \Phi_2, \dots, \Phi_n)(x) \neq 0$ for all x in I.

B) Attempt any one: 07

c) Consider the differential equation
$x^2y" - 7xy' + 15y = 0$.
Prove that the function $\Phi_1(x) = x^3, (x > 0)$ is solution of above differential equation and find second independent solution.

d) Find two linearly independent power series solution of
$y" + y = 0$

Q.3 A) Attempt any one: 08

a) Show that

$$\int_{-1}^{1} p_n(x)p_m(x)dx = 0 \, , if \; n \neq m$$

b) Show that there is a basis Φ_1, Φ_2 for the solutions of
$x^2y" + 4xy' + (2 + x^2)\, y = 0 \, , x > 0$

B) Attempt any one: 07

c) Find the singular points of the equation
$x^2y" + (x + x^2)y' - y = 0$
And determine those which are regular singular points.

d) Suppose Φ is any solution of
$x^2y" + xy' + x^2y = 0$ for $x > 0$, and let $\psi(x) = x^{\frac{1}{2}}\Phi(x)$
Show that ψ satisfies the equation
$x^2y" + (x^2 + \frac{1}{4})y = 0$ for $x > 0$

Q.4 Choose the correct alternative: 10

1) The equation
$(1 - x^2)y" - 2xy' + \alpha(\alpha + 1)y = 0$
Where α is a constant is known as ……
a) Bessels equation b) Legendre equation c) Euler's equation d) Abel equation

2) If $P_n(-x) = (-1)^n P_n(x)$ then $P_n(-1) = \cdots$ ...
a) $(-1)^n$ b) $(1)^n$ c) 1 d) n

3) If $a_0(x)y^{(n)} + a_1(x)y^{(n-1)} + \cdots + a_n(x)y = b(x)$
Point where $a_0(x) = 0$ is called ________
a) Regular Point
b) Regular and Singular point
c) Singular point
d) Neither regular nor singular point

4) If $\Phi_1, \Phi_2, \ldots, \Phi_n$ are defined on an interval I is called linearly independent if there exist a constants $c_1, c_2, \ldots c_n$ such that $c_1\Phi_1 + c_2\Phi_2 + \cdots + c_n\Phi_n = 0$ then
   a) $c_1 = c_2 = \cdots = c_n = 0$
   b) $c_1 = c_2 = \cdots = c_n \neq 0$
   c) $c_1 = 1, c_2 = c_3 = \cdots = c_n$
   d) $c_1 = 0, c_2 = c_3 = \cdots = c_n = 1$

5) If $\Phi_1, \Phi_2, \ldots, \Phi_n$ are n solutions of
   $L(y) = y^{(n)} + a_1(x)y^{(n-1)} + \cdots + a_n(x)y = 0$
   On an interval I and let x_0 be any point in I. then__________
   a) $W(\Phi_1, \Phi_2, \ldots, \Phi_n) = \exp[\int_{x_0}^{x} a_1(t)dt]W(\Phi_1, \Phi_2, \ldots, \Phi_n)(x_0)$
   b) $W(\Phi_1, \Phi_2, \ldots, \Phi_n) = \exp[-\int_{x_0}^{x} a_1(t)dt]W(\Phi_1, \Phi_2, \ldots, \Phi_n)(x_0)$
   c) $W(\Phi_1, \Phi_2, \ldots, \Phi_n) = \exp[\int_{x_0}^{x} a_1(t)dt]$
   d) $W(\Phi_1, \Phi_2, \ldots, \Phi_n) = \int_{x_0}^{x} a_1(t)dt$

OR

Total No. of Printed Pages:2

SUBJECT CODE NO:- L-2047
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. T.Y (Sem-VI) Examination March/April 2019
Mathematics MAT
3) Programming in C-II-605

[Time: 1:30 Hours] **[Max.Marks: 40]**

Please check whether you have got the right question paper.

N.B
1) All questions are compulsory.
2) Assume the data wherever not given.
3) Figures to the right indicate full marks.

Q.1 A) Attempt any one: 05
a) Write the general form of a simple if statement and draw flowchart of simple if control.
b) Explain how goto statement is used to transfer the control out of a loop.

B) Attempt any one: 05
c) Explain ?: operator in C language with example
d) Write the general form of the else if ladder and draw flow chart of it.

Q.2 A) Attempt any one: 05
a) What is structured programming? Discuss in detail.
b) Explain entry – controlled loop and exit – controlled loop.

B) Attempt any one: 05
a) Write a program using for loop to print the 'power of 2' table for the power 0 to 10, both positive and negative.
b) Write a program to calculate the sum of squares of all integers between 1 and 10 using if statement.

Q.3 A) Attempt any one: 05
a) Explain in detail multi-dimensional arrays.
b) Discuss compile time initialization in detail with example.

B) Attempt any one: 05
a) Write a program to determine median for the given data. (Assume data)
b) Write a program using a single subscripted variable to evaluate

$$Total = \sum_{i=1}^{10} x_i^2$$

Q.4 Fill in the blanks: 10

a) The initialization and increment sections are omitted in the ______
b) The while statement is an ______________ loop statement
c) The if ------else statement is an extension of the _________
d) The complete set of values is called an __________
e) The ________ of the inner loop does not contain any new line character.

Total No. of Printed Pages:02

SUBJECT CODE NO:- L-2048
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. S.Y. (Sem-IV) Examination March/April 2019
Mathematics MAT - 403
Mechanics-II

[Time: 1:30 Hours] **[Max.Marks: 50]**

Please check whether you have got the right question paper.

N.B
i) Attempt all questions.
ii) Figures to the right indicate full marks.
iii) Draw well labeled diagram wherever necessary.

Q.1 A) Attempt any one: 08

a) Find the components of the acceleration along and perpendicular to the radius vector.

b) Prove that the kinetic energy of a particle of mass m moving with velocity $\vec{V}$ is $\frac{1}{2}\, m\, V^2$.

B) Attempt any one: 07

c) If the tangential and normal accelerations of a particle describing a plane curve is constant throughout the motion, them prove that the angle Ψ through which the direction of the motion turns in time t is given by $\Psi = A \log(1 + Bt)$.

d) A bullet moving at the rate of V cm/sec is fired into a block of wood and penetrates into a thickness of d cm. if the block of wood has been $\frac{d}{2}$ cm, then find the velocity with which the bullet would have emerged through the block.

Q.2 A) Attempt any one: 08

a) Find the vertex and latus rectum of the path of a projectile.

b) Find the differential equation of the path of a particle moving under a central force f(r) directed towards a fixed point O in a plane in pedal form.

B) Attempt any one: 07

c) If a particle is projected at an angle of elevation $\sin^{-1}\left(\frac{4}{5}\right)$ and its range on the horizontal plane is 4 miles, then find the velocity of projection and the velocity at the highest point of its path.

d) Find the law of central force, if the path of the particle is $r^2 = a^2 cos2\theta$.

Q.3 A) Attempt any one 05

a) If the particle moves along a curve CPQ and its position at time t is P and at time $t + \Delta t$ is Q such that $\overrightarrow{OP} = \vec{r}, \overrightarrow{OQ} = \vec{r} + \Delta\vec{r}$, then prove that areal velocity at P is $\frac{1}{2}(\vec{r} \times \vec{v})$, where $\vec{v}$ is a velocity of particle.

b) Prove that the sum of the work done by any number of forces is equal to the work done by their resultant.

B) Attempt any one: 05

c) Prove that the acceleration of a point moving in a plane curve with uniform speed is $\rho\left(\frac{d\Psi}{dt}\right)^2$.

d) A man can throw a cricket ball up to 160 m and no more with what speed m/sec must it be thrown? Take $g = 9.8\, m/\sec^2$

Q.4 Choose the correct alternative and rewrite the sentence. 10

1) If the velocity is uniform then the acceleration is ________
a) Unit b) Zero c) Double the velocity d) Equal to the speed

2) In M.K.S. system the unit of force is ___________
a) Newton b) Joules c) Watts d) Radians

3) The path is described by the particle moving under a central force is ________________
a) Focal orbit b) Radial orbit c) Central orbit d) Apse

4) Acceleration due to gravity g will be positive, if the particle is moving ________
a) Horizontally right b) Horizontally left
c) Vertically upward d) Vertically downward

5) The time rate of change of velocity is known as __________
a) A speed b) Acceleration c) Displacement d) Areal velocity