Sr. No: 100446 Roll No________________

B. Sc. (HONS.) MATHEMATICS – 3rd SEMESTER EXAMINATION; DECEMBER - 2017

[SUB: - ADVANCE CALCULUS; PAPER CODE: 09050301]

Time: 3 Hrs. **Max. Marks: 75**

Instructions:-

1. Write your Roll No. on the Question paper.
2. Candidates should ensure that they have been provided correct question paper. Complaints in this regard, if any, should be made within 15 minutes of the commencement of the exam. No complaint(s) will be entertained thereafter.
3. Attempt Five (5) Questions in all, Question No. 1 is compulsory. Attempt other 4 questions selecting at least one question from each unit. All question carry equal marks
4. Draw diagram wherever required.

Q1. Answer all the following questions :- (15)

(a) State Darboux intermediate value theorem for derivatives.
(b) Define repeated and simultaneously limit for two variables.
(c) State Schwarz's theorem.
(d) Define Bertrand's curve.

UNIT-I

Q2. (a) Show that a function which is continuous in an interval is bounded in that interval. (8)

(b) If $f(x+h)=f(x)+hf'(x+\theta h)$ find the value of θ when $f(x)=x^2$ (7)

Q3. (a) Evaluate $\lim_{x\to\infty}\left(1+\frac{a}{x}\right)^x$ (8)

(b) Discuss the continuity and discontinuity of the function

$$f(x)=\frac{xe^{1/x}}{1+e^{1/x}}+\sin\frac{1}{x}, f(0)=0$$ (7)

UNIT-II

Q4. (a) Check the continuity of the function at origin

$$f(x,y)=\frac{xy}{\sqrt{x^2+y^2}},(x,y)\neq(0,0)$$

$$=0,(x,y)=(0,0)$$ (8)

(b) If $u=\sin^{-1}\left(\frac{x}{y}\right)+\tan^{-1}\left(\frac{x}{y}\right)$ Show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=0$ (7)

Q5. (a) If $x^x y^y z^z = c$ show that $x=y=z$

$$\frac{\partial^2 z}{\partial x\partial y}=-\frac{1}{x\log ex}$$ (8)

(b) Using Euler's theorem for the function $u=\sin^{-1}\frac{x^2+y^2}{x-y}$ show that $\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=\tan u$ (7)

UNIT-III

Q6. Show that the function $f(x,y) = xy\dfrac{(x^2 - y^2)}{(x^2 + y^2)}; (x,y) \neq (0,0)$

$$= 0, (x,y) = (0,0)$$

Is differentiable at origin also calculate $f_{xy}(0,0)$ and $f_{yx}(0,0)$ are they equal? (15)

Q7. (a) Show that the minimum value of $u = xy + a^3\left(\dfrac{1}{x} + \dfrac{1}{y}\right)$ is $3a^2$ (8)

(b) Find the minimum value of $x^2 + y^2 + z^2$ subject to conditions $x + y + z = 1$ and $xyz + 1 = 0$ (7)

UNIT-IV

Q8. (a) Show that the radius R of the space of curvature is given by $R^2 = \rho^4\sigma^2 r^{-1112} - \sigma^2$ (8)

(b) Show that the locus of centre of curvature is evolutes when the curve is plane. (7)

Q9. Is $x = a\cos t, y = \sin t, z = ct$, a plane curve? Calculate the curvature and torsion of the given curve. (15)

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Sr. No: 1662447 Roll No________________

B. SC (Hons.) MATHEMATICS– 3RD SEMESTER EXAMINATION; DECEMBER - 2017

[SUB: - PARTIAL DIFFERENTIAL EQUATIONS; PAPER CODE: 09050302]

Time: 3 Hrs. **Max. Marks: 75**

Instructions:-

1. Write your Roll No. on the Question paper.
2. Candidates should ensure that they have been provided correct question paper. Complaints in this regard, if any, should be made within 15 minutes of the commencement of the exam. No complaint(s) will be entertained thereafter.
3. Attempt Five (5) Questions in all, Question No. 1 is compulsory. Attempt other 4 questions selecting one question from each unit. Marks are indicated against each question.
4. Draw diagram wherever required.

Q.1. Answer the following questions: **(5x3=15)**

(a) Form the partial differential equation by eliminating the arbitrary constants a and b from the equation: $z = ax + by + a^2 + b^2$.

(b) Examine whether the following system of partial differential equations are compatible or not: $\frac{\partial z}{\partial x} = 7x + 18y - 1$, $\frac{\partial z}{\partial y} = 9x + 11y - 2$.

(c) Find whether the following partial differential equation is hyperbolic, parabolic or elliptic in nature : $y^2 \frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial y^2} + 4z = 0$

(d) Classify following partial differential equations into linear, semi-linear, quasi-linear or non-linear: **(i)** $pq = z$

(ii) $x^2zp + y^2zp = xy$

(iii) $xyp + x^2yq = x^2y^2z^2$

(e) For the partial differential equations determine whether real characteristics exist or not

$$2\frac{\partial^2 u}{\partial x^2} - 2\frac{\partial^2 u}{\partial x \partial y} - 5\frac{\partial^2 u}{\partial y^2} = 0$$

UNIT-I

Q.2. (a) Show that the equations $xp - yq = x$, $x^2p + q = xz$ are compatible and find their solution **(8)**

(b) Obtain the partial differential equation by eliminating the arbitrary functions from:

$$z = f(x - ay) + g(x + ay)$$ **(7)**

Q.3. (a) Solve the partial differential equation $p_1x_1 + p_2x_2 = p_3^2$ by using Jacobi's method. (8)

(b) Solve the partial differential equation $p\ tanx + q\ tany = tanz$. (7)

UNIT-II

Q.4. (a) Solve the equation: $(D^2 - 2DD' + D'^2)z = 12xy$. (7)

(b) Solve $(x^2D^2 - xyDD' - 2y^2D'^2 + xD - 2yD')z = \log\frac{y}{x} - \frac{1}{2}$. (8)

Q.5. (a) Solve the differential equation: $(D - D' - 1)(D - D' - 2)z = \sin(2x + 3y)$. (7)

(b) Solve: $(x^2D^2 + 2xyDD' - xD)z = \frac{x^3}{y^2}$. (8)

UNIT-III

Q.6.(a) Find the complete integral of following partial differential equation using Monge's method: $2pr + 2qt - 4pq(rt - s^2) = 1$ (5)

(b) Classify the equation $\frac{\partial^2 z}{\partial x^2} - 4\frac{\partial^2 z}{\partial x \partial y} + 4\frac{\partial^2 z}{\partial y^2} = 0$ and then reduce to canonical form and hence solve it. (10)

Q.7. (a) Classify the following partial differential equation as elliptic, hyperbolic or parabolic:

(i) $\frac{\partial^2 z}{\partial x^2} + y^2\frac{\partial^2 z}{\partial y^2} = y$

(ii) $\frac{\partial^2 z}{\partial x^2} + 2\frac{\partial^2 z}{\partial x \partial y} + \frac{\partial^2 z}{\partial y^2} + 3\frac{\partial z}{\partial x} + 9z = 0.$

(iii) $x^2(y - 1)r - x(y^2 - 1)s + y(y - 1)t + xyp - q = 0$

(iv) $2r + 4s + 3t - 2 = 0$ (2x4=8)

(b) Solve the equation using Monge's method: $r + 5s + 6t = 0$. (7)

UNIT-IV

Q.8. Solve the Cauchy problem: $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial y^2} = 0$ subject to the conditions

$z(x, 0) = f(x)$ and $\frac{\partial z}{\partial y} = g(x)$ at $y = 0$ (15)

Q.9. Find the solution of wave equation $\frac{\partial^2 u}{\partial x^2} = \frac{1}{c^2} \cdot \frac{\partial^2 u}{\partial t^2}$ for which

$u(0, t) = 0 = u(l, t), u(x, 0,) = 0$ and $\frac{\partial u}{\partial t} = u_0 sin^3\frac{\pi x}{l}$ at $t = 0$ (15)

Sr. No: 100468 Roll No______________

B. Sc. (HONS.) MATHEMATICS – 3rd SEMESTER EXAMINATION; DECEMBER - 2017

[SUB: - STATICS; PAPER CODE: 09050303]

Time: 3 Hrs. **Max. Marks: 75**

Instructions:-

1. Write your Roll No. on the Question paper.
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3. Attempt Five (5) Questions in all, Question No. 1 is compulsory. Attempt other 4 questions selecting at least one question from each unit. All question carry equal marks
4. Draw diagram wherever required.

Q1. Answer all the following questions :- (5X3=15)

(a) Define Null lines, Null planes and Null point with example.
(b) Define Poinsot's Central axis.
(c) State and prove Lami's theorem.
(d) Find the resultant wrench of two given wrenches.
(e) Find Centre of gravity of circular disc.

UNIT-I

Q2. (a) An endless chain of weight W rests in the form of a circular band round a smooth vertical cone which has its vertex upwards. Find the tension in the chain due to its weight, assuming the vertical angle of the cone to be 2α. (8)

(b) To show that any system of forces acting on a rigid body can be reduced to a single force together with a couple whose axis is along the direction of the force. (7)

Q3. (a) If forces of magnitudes P, Q and R act at the point parallel to the sides BC,CA and AB respectively of a triangle ABC. Prove that magnitude of their resultant is

$$\sqrt{P^2+Q^2+R^2-2QRvC\text{os}\,A-2PRC\text{os}\,B-2PQC\text{os}\,C} \quad (8)$$

(b) O is the circumcentre of the triangle ABC. A force R act along AO. Resolve R into and acting two forces parallel to it and acting at B and C respectively. (7)

UNIT-II

Q4. (a) If O be the pole of lemniscates $r^2 = a2C\text{os}\,2\theta$ and G is the centre of gravity of the arc PQ of the curve. Prove that OG bisects the angle POQ. (8)

(b) Find the Null points of the plane $x+y+z=0$ for the force system (X, Y, Z, L, M, N) (7)

Q5. (a) A body consists of cone and hemisphere on the same base rests on a rough horizontal table. The hemisphere being in contact with the table. Show that the greatest height of the cone so that the equilibrium may be stable is $\sqrt{3}$ times the radius of the hemisphere. (8)

(b) A hemisphere rests in equilibrium on a sphere of equal radius. Show that the equilibrium is unstable when the curved and stable when the flat surface of the hemisphere rests on the sphere. (7)

UNIT-III

Q6. (a) Forces X, Y, Z act along three straight lines $y = b, z = -c, x = -a$ and $x = a, y = -b$ respectively. Show that this will have a single resultant if $\frac{a}{x} + \frac{b}{y} + \frac{c}{z} = 0$ and that the equations of its line of action are any two of the three $\frac{y}{Y} - \frac{z}{Z} - \frac{a}{x} = 0, \frac{z}{Z} - \frac{x}{X} - \frac{b}{Y} = 0, \frac{x}{X} - \frac{y}{Y} - \frac{c}{Z} = 0$ (8)

(b) If P and Q are like forces. If P moved parallel to itself through the distance x. Show that the resultant of and Q moves through a distance $\frac{Px}{P+Q}$. (7)

Q7. (a) A heavy elastic string whose natural length is $2\,2\pi a$ is place around a smooth cone whose axis is vertical angle is α. If ω be the weight λ the modulus of elasticity of string. Prove that it will be in equilibrium when in the form of a circle of radius $\alpha\left(1 + \frac{\omega}{2\pi\lambda}\cot\alpha\right)$ (8)

(b) Two forces P and Q act along the straight lines whose equations are $y = x\tan\alpha, z = c$ and $y = -x\tan x, z = -c$ respectively. Show that their central axis lies on a straight line.

$$y = x\frac{P-Q}{P+Q}\tan\alpha, \qquad \frac{z}{c} = \frac{P^2 - Q^2}{P^2 + 2PQ\cos 2\alpha + Q^2}$$ (7)

UNIT-IV

Q8. (a) Show that the wrench (X, Y, Z, L, M , N) is equivalent to two forces one along the line $x = y = z$ and the other along the line given by $Lx + My + Nz = 0,\ x(Y-Z) + y(Z-X)$ $+z(X-Y) = L + M + N$ and find the magnitude of the forces. (8)

(b) Wrenches of the same pitch p act along the edges of regular tetrahedron ABCD of side a. If the intensities of the wrenches along *AB, DC* are the same and also those along *BC, DA* and *DB, CA*. Show the pitch of the equivalent wrench is $p + \frac{a}{2\sqrt{2}}$. (7)

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Sr. No: 100469 Roll No________________

B. Sc. (HONS.) MATHEMATICS – 3rd SEMESTER EXAMINATION; DECEMBER - 2017

[SUB: - DIFFERENTIAL GEOMETRY; PAPER CODE: 09050304]

Time: 3 Hrs. **Max. Marks: 75**

Instructions:-

1. Write your Roll No. on the Question paper.
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3. Attempt Five (5) Questions in all, Question No. 1 is compulsory. Attempt other 4 questions selecting at least one question from each unit. All question carry equal marks
4. Draw diagram wherever required.

Q1. (a) Prove that $n' = \tau b - kt$ for point on a space curve $\vec{r} = r(s)$ (5X3=15)

(b) Prove that the surface $xyz = a^2$ is not developable.

(c) Define Osculating developable and Polar developable.

(d) Calculate first-order magnitudes for $x = u\cos\phi, y = u\sin\phi, z = f(u)$

(e) Find envelope of the plane $3xt^2 - 3yt + z = t^3$

UNIT-I

Q2. (a) Find envelope of the plane $lx + my + nz = p$ where $a^2l^2 + b^2m^2 + 2np = 0$ (7)

(b) Prove that the space curve is itself is the edge of regression of the osculating developable. (8)

Q3. (a) Find edge of regression of the envelope of the family of planes $x\sin\theta - y\cos\theta + z = a\theta$, where Θ is a parameter. (6)

(b) Show that the edge of regression of the polar developable of space curve is the locus of the centre of spherical curvature. (9)

UNIT-II

Q4. (a) Show that the necessary and sufficient condition for the parametric curves form an orthogonal system. (9)

(b) On the surface of revolution $x = u\cos\phi, y = u\sin\phi, z = f(u)$ what are the parametric curves $u =$ constant, $\phi =$ constant. Also deduce that whether parametric curves form orthogonal system or not. (6)

Q5. (a) If the two directions dr & δr are perpendicular then prove that the DE formed is

$$(EQ - FP)du + (FQ - GP)dv = 0 \text{ Where } p = E\frac{du}{dv} + F, Q = F\frac{du}{dv} + G$$

OR

Deduce whether yes/no, the orthogonality of the parametric curves on the surface of revolution given by $r = \left(\cos u\cos v, \cos u\sin v, -\sin u + \log\left(\tan\left(\frac{\pi}{4} + \frac{u}{2}\right)\right)\right)$ (9)

(b) What are the parametric curves $u = \text{const}$, $v = \text{const}$ for $x = u\cos v, y = u\sin v, z = cv$ are parametric curves orthogonal? If yes/no, then explain (6)

UNIT-III

Q6. (a) If $\vec{r} = r(s)$ is the position vector of a point with arc length s as parameter on a curve C and then prove that a) $k^2 = r''.r''$ b) $k^2\tau = [r', r'', r''']$ (where dash denote differentiation of r w.r.t s) (8)

(b) Find torsion of the curve given by $r = (at - a\sin t, a - a\cos t, bt)$ (7)

Q7. If $\vec{r} = r(u)$ is the equation of curve with parameter u, then prove that (a) $k = \dfrac{|\dot{r} \times \ddot{r}|}{|\dot{r}|^3}$

(b) $\tau = \dfrac{[\dot{r}, \ddot{r}, \dddot{r}]}{[\dot{r}, \ddot{r}]^2}$ (where the dot denotes differentiation of r w.r.t u. Hence find k for $\vec{r} = (a\cos u, a\sin u, bu)$. (10+5=15)

UNIT-IV

Q8. (a) Give definition of Geodesic on a surface. Also deduce mathematical expression to define Geodesic. What is necessary and sufficient condition for a curve $u = u(t), v = v(t)$ on a surface $\vec{r} = r(u, v)$ to be geodesic. (9)

(b) Prove that necessary and sufficient condition that a curve is a plane curve is $[\dot{r}, \ddot{r}, \dddot{r}] = 0$ (6)

Q9. (a) A necessary and sufficient condition for a given curve to be a plane curve is $\tau = 0$ at all points of curve. (6)

(b) Find k & τ of the circular helix $r = (a\cos u, a\sin u, bu)$ (9)

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Sr. No: 100469 Roll No________________

B. Sc. (HONS.) MATHEMATICS – 3rd SEMESTER EXAMINATION; DECEMBER - 2017

[SUB: - DIFFERENTIAL GEOMETRY; PAPER CODE: 09050304]

Time: 3 Hrs. **Max. Marks: 75**

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(b) Prove that the surface $xyz = a^2$ is not developable.

(c) Define Osculating developable and Polar developable.

(d) Calculate first-order magnitudes for $x = u\cos\phi, y = u\sin\phi, z = f(u)$

(e) Find envelope of the plane $3xt^2 - 3yt + z = t^3$

UNIT-I

Q2. (a) Find envelope of the plane $lx + my + nz = p$ where $a^2l^2 + b^2m^2 + 2np = 0$ (7)

(b) Prove that the space curve is itself is the edge of regression of the osculating developable. (8)

Q3. (a) Find edge of regression of the envelope of the family of planes $x\sin\theta - y\cos\theta + z = a\theta$, where Θ is a parameter. (6)

(b) Show that the edge of regression of the polar developable of space curve is the locus of the centre of spherical curvature. (9)

UNIT-II

Q4. (a) Show that the necessary and sufficient condition for the parametric curves form an orthogonal system. (9)

(b) On the surface of revolution $x = u\cos\phi, y = u\sin\phi, z = f(u)$ what are the parametric curves u =constant, ϕ =constant. Also deduce that whether parametric curves form orthogonal system or not. (6)

Q5. (a) If the two directions dr & δr are perpendicular then prove that the DE formed is

$$(EQ - FP)du + (FQ - GP)dv = 0 \text{ Where } p = E\frac{du}{dv} + F, Q = F\frac{du}{dv} + G$$

OR

Deduce whether yes/no, the orthogonality of the parametric curves on the surface of revolution given by $r = \left(\cos u\cos v, \cos u\sin v, -\sin u + \log\left(\tan\left(\frac{\pi}{4} + \frac{u}{2}\right)\right)\right)$ (9)

(b) What are the parametric curves $u = \text{const}$, $v = \text{const}$ for $x = u\cos v, y = u\sin v, z = cv$ are parametric curves orthogonal? If yes/no, then explain (6)

UNIT-III

Q6. (a) If $\vec{r} = r(s)$ is the position vector of a point with arc length s as parameter on a curve C and then prove that a) $k^2 = r''.r''$ b) $k^2\tau = [r', r'', r''']$ (where dash denote differentiation of r w.r.t s) (8)

(b) Find torsion of the curve given by $r = (at - a\sin t, a - a\cos t, bt)$ (7)

Q7. If $\vec{r} = r(u)$ is the equation of curve with parameter u, then prove that (a) $k = \dfrac{|\dot{r} \times \ddot{r}|}{|\dot{r}|^3}$

(b) $\tau = \dfrac{[\dot{r}, \ddot{r}, \dddot{r}]}{[\dot{r}, \ddot{r}]^2}$ (where the dot denotes differentiation of r w.r.t u. Hence find k for $\vec{r} = (a\cos u, a\sin u, bu)$. (10+5=15)

UNIT-IV

Q8. (a) Give definition of Geodesic on a surface. Also deduce mathematical expression to define Geodesic. What is necessary and sufficient condition for a curve $u = u(t), v = v(t)$ on a surface $\vec{r} = r(u, v)$ to be geodesic. (9)

(b) Prove that necessary and sufficient condition that a curve is a plane curve is $[\dot{r}, \ddot{r}, \dddot{r}] = 0$ (6)

Q9. (a) A necessary and sufficient condition for a given curve to be a plane curve is $\tau = 0$ at all points of curve. (6)

(b) Find k & τ of the circular helix $r = (a\cos u, a\sin u, bu)$ (9)

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Sr. No: 100471 Roll No________________

B. Sc. (HONS.) MATHEMATICS – 3rd SEMESTER EXAMINATION; DECEMBER - 2017

[SUB: - DATABASE MANAGEMENT & ORACLE; PAPER CODE: 09050307]

Time: 3 Hrs. **Max. Marks: 75**

Instructions:-

1. Write your Roll No. on the Question paper.
2. Candidates should ensure that they have been provided correct question paper. Complaints in this regard, if any, should be made within 15 minutes of the commencement of the exam. No complaint(s) will be entertained thereafter.
3. Attempt Five (5) Questions in all, Question No. 1 is compulsory. Attempt other 4 questions selecting at least one question from each unit. All question carry equal marks
4. Draw diagram wherever required.

Q1. Answer all the following questions :- (5X3=15)

(a) What are the disadvantages of DBMS?
(b) Differentiate Primary, Candidate and Super Keys.
(c) What do you mean by Oracle Functions?
(d) What are Test Reports?
(e) Give different data types available in PL/SQL.

UNIT-I

Q2. (a) Differentiate DBMS and File systems. Explain the architecture of the Data Base Management System in detail. (8)

(b) Differentiate Logical Data Independence and Physical Data Independence. Explain with help of an example. (7)

Q3. (a) What do you mean by Relational Calculus" Explain Domain and Tuple Relational Calculus in detail with the help of suitable examples. (7)

(b) What do you mean by Data Models? Explain various Data Models used in DBMS along with their advantages and disadvantages. (8)

UNIT-II

Q4. (a) What are functional dependencies? How can we determine that the decomposition of a relation into two or more relations is Dependency Preserving? Explain with the help of an example. (7)

(b) What is the job of Query Processor? What are different strategies to process a query? (8)

(8)

Q5. (a) What do you mean by Normalization? Normalization a table from 1st NF to 3rd NF and explain the anomalies removed after each NF. (8)

(b) What are different security issues related to database? How can we handle them? (7)

UNIT-III

Q6. (a) What do you mean by SQL? Explain the table modification commands in SQL. (7)

(b) Explain User-Defined forms and Master-Detail forms. How they can be created? (8)

Q7. (a) What do you mean by transaction in Oracle? Explain its various properties with help of suitable examples. (7)

(b) Explain Package Functions and Package Procedures? How these can be created? Explain with help of examples. (8)

UNIT-IV

Q8. (a) What is the use of SQL* Report Writer? Explain how we can create a Selective Dump Report. (8)

(b) Explain the syntax to create and drop a Trigger. (7)

Q9. (a) What do you mean by Database Triggers and Declarative Integrity Constrains? Explain how Database Triggers are different from Declarative Integrity constraints? (7)

(b) Write a Trigger to carry out the following action:
On updating any record of the Employee table, the old values must be inserted into the Logs table. (8)

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