UNIVERSITY OF THE PUNJAB

B.A. / B.Sc. (Composite) Annual Exam – 2019

Subject: Mathematics General
PAPER: A

MAX. TIME: 3 Hr.
MAX. MARKS: 100

***Note:** Attempt any SIX questions by selecting TWO questions from Section – I, TWO questions from Section – II, ONE question from Section – III and ONE question from Section – IV.*

Section-I

Q. 1. (a) Solve the inequality 8+9

$$\frac{2x}{x+2} \geq \frac{x}{x-2}$$

(b) If $\arctan\left(\frac{y}{x}\right) + yx^2 = 1$, then find $\frac{dy}{dx}$

Q. 2. (a) Discuss the validity of Rolle's Theorem for the function $f(x) = x(x+3)e^{\frac{-x}{2}}$ on [-3, 0] and also find c such that $f'(c) = 0$ 8+9

(b) Evaluate: $\lim_{x\to 0} \frac{\ln(1-x^2)}{\ln \cos x}$

Q. 3. (a) Find the positional nature of the multiple points on the curve

$x^2(x-y) + y^2 = 0$ 8+9

(b) Show that for the **parabola** $y = ax^2 + bx + c$,

the radius of curvature ρ is minimum at its vertex.

Q. 4. (a) Find the equations of the tangents at the multiple points of the curve 8+9
$(y-2)^2 = x(x-1)^2$

(b) Find the intervals in which the curve:

$y = (x^2 + 4x + 5)e^{-x}$

Faces upward or downward. Also find its points of inflection.

Section-II

Q. 5. Evaluate the integrals. 5, 6, 6

i. $\int \frac{1}{(x+1)\sqrt{x^2-1}} dx$ **ii.** $\int \frac{1}{\tan x - \sin x} dx$ **iii.** $\int \tan^{-1}\left(\sqrt{\frac{1-x}{1+x}}\right) dx$

P.T.O.

Q. 6. (a) Show that $\int_0^{\pi} \frac{x}{1+\sin x} dx = \pi$ 8+9

(b) Show that : $\int sec^{2n+1}x \ dx = \frac{sec^{2n-1}x \tan x}{2n} + \left(1 - \frac{1}{2n}\right) \int sec^{2n-1}x \ dx$

Q. 7. (a) Find the area of the smaller segment cut from a circular disc of radius "a" by a chord at a distance "b" from the centre, $(a > b)$. 8+9

(b) Sketch the graph of the curve: $r = a \cos 3\theta$, $a > 0$

Q. 8. (a) Find the surface area generated by revolving the line segment between $(r_1, 0)$ and (r_2, h) *about the* $y - axis$ 8+9

(b) Show that intrinsic equation of $3ay^2 = 2x^3$ is $9s = 4a\,(sec^3\alpha - 1)$

Section-III

Q. 9. (a) Determine the series $\sum_1^{\infty} \frac{\ln(n+1)}{n^2}$ converges or diverges. 8+8

(b) Test the series for absolute convergence, conditional convergence or divergence

$\sum_1^{\infty} \frac{(-1)^n(n+2)}{n(n+1)}$

Q. 10. (a) Determine convergence or divergence of: 8+8

$\sum_1^{\infty} \frac{\arctan n}{n^2}$

(b) Find the interval and radius of convergence of $\sum_{n=2}^{\infty} \frac{(-1)^n x^n}{n(\ln n)^2}$

Section-IV

Q. 11. (a) Find the extreme values of the function 8+8

$f(x, y) = \frac{1}{x} + xy - \frac{8}{y}$

(b) If $u = \arcsin\left(\frac{x^2+y^2}{x+y}\right)$, *verify that* $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \tan u$

Q. 12. (a) A dome is in the shape of a hemisphere with radius 60 feet. The dome is to be painted with a layer of 0.01 inch thickness. Use cifferentials to estimate the amount of the paint required. 8+8

(b) If $f(x, y) = \frac{x^2+y^2}{x-y}$, prove that

$(f_x - f_y)^2 = 4(1 - f_x - f_y)$

UNIVERSITY OF THE PUNJAB

B.A. / B.Sc. (Composite) Annual Exam – 2019

Subject: Mathematics General
PAPER: B

MAX. TIME: 3 Hr.
MAX. MARKS: 100

Note: ***Attempt SIX questions in all selecting TWO questions from Section – I, TWO questions from Section – II, ONE question from Section – III and ONE question from Section-IV.***

Section - I

Q.1 (a) For what value of λ the equation. $\lambda xy + 5x + 3y + 2 = 0$ represents a pair of straight lines.

(b) Find equation of tangent and normal to the curve $x(x^2 + y^2) - ay^2 = 0$ at point $\left(\frac{a}{2}, \frac{a}{2}\right)$. 9, 8

Q.2 (a) Show that the curve whose parametric equations are

$x = a\cos\theta + h$ and $y = b\sin\theta + k$ where $0 \le \theta \le 2\pi$ is an ellipse with center (h, k).

(b) Find the pedal equation of the curve $r = a(1 + \sin\theta)$. 9, 8

Q.3 (a) Find the volume of parallelopiped having edges $\bar{a} = 3i + 2k$, $\bar{b} = i + 2j + k$ and $\bar{c} = -j + 4k$.

(b) If $\bar{r} = t^3 i + \left(2t^3 - \frac{1}{5t^2}\right) j$. Show that $r \times \frac{dr}{dt} = k$. 9, 8

Q.4 (a) If $F = 2yz\,\bar{i} - x^2y\,\bar{j} + xz^2\,\bar{k}$ and $\phi = 2x^2yz^3$, then find $(F \cdot \nabla)\,\phi$.

(b) If $\bar{a} = i - 2j + k$, $\bar{b} = 2i + j + k$ and $\bar{c} = i + 2j - k$, then find $a \times (b \times c)$. 9, 8

Section - II

Q.5 (a) Find measure of the angle between the straight lines

$$L: \frac{x-2}{1} = \frac{y-3}{1} = \frac{z+1}{2} \quad \text{and} \quad M: \frac{x-2}{2} = \frac{y-3}{-1} = \frac{z+1}{3}$$

(b) Find perpendicular distance of the point A (3, −1, 2) to the plane $2x + y - z - 4 = 0$. Reduce the equation of the plane to the normal form. 9, 8

Q.6 (a) Show that the shortest distance between the lines $x + a = 2y = -12z$ and $x = y + 2a = 6(z - a)$ is $2a$.

(b) Find equation of the cone whose directrix is $y^2 = x$, $z = 4$ and whose vertex is at A (0, 2, 0). 9, 8

Q.7 (a) Find the direction of Qibla at a place with latitude $23^0\ 42'$N and longitude = $90^0\ 22'$ E.

(b) Evaluate $\left(\frac{\sqrt{6} - i}{\sqrt{3} + i}\right)^8$. 9, 8

Q.8 (a) If $z = x + iy$, then show that $\log\left(\frac{z}{\bar{z}}\right) = 2i\tan^{-1}\left(\frac{y}{x}\right)$.

(b) If $\sin(A + iB) = x + iy$, then show that $\frac{x^2}{\sin^2 A} - \frac{y^2}{\cos^2 A} = 1$. 9, 8

Section - III

Q.9 (a) If A is a square matrix over C, show that $A + (\bar{A})^t$ is Hermitian.

(b) Solve the system of equations. 8, 8

$$x_1 + 5x_2 + 2x_3 = 9$$
$$x_1 + x_2 + 7x_3 = 6$$
$$-3x_2 + 4x_3 = -2$$

Q.10 (a) If $A = \begin{bmatrix} 1 & -1 & 3 \\ 4 & 1 & 6 \\ 2 & 0 & -2 \end{bmatrix}$ then find A^{-1}.

(b) Write the vector $V = (1, -2, 5) \in R^3$ as a linear combination of the vectors $V_1 = (1, 1, 1)$, $V_2 = (1, 2, 3)$ and $V_3 = (2, -1, 1)$. 8, 8

Section - IV

Q.11 (a) Solve $(e^x + 1)\,y\,dy = (y + 1)\,e^x\,dx$.

(b) Solve the initial value problem 8, 8

$$\frac{dy}{dx} + \frac{y}{2x} = \frac{x}{y^3} \quad \text{When } y(1) = 2$$

Q.12 (a) Find General solution of $(D^3 - 2D^2 - 3D + 10)\,y = 40\cos x$.

(b) Solve $x^2\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2y = x^3$. 8, 8

UNIVERSITY OF THE PUNJAB

B.A. / B.Sc. (Composite) Annual Exam – 2019

MAX. TIME: 3 Hr.
MAX. MARKS: 100

Subject: Mathematics A Course
PAPER: A

NOTE: Attempt any SIX questions in all by selecting TWO questions from each Section I & II and ONE question from each Section III & IV.

SECTION – I

Q.1: (9,8)

(a) Differentiate $(\text{arc}\sin x)^{x^{y_x}}$ $w.r.t\ x$

(b) Let $f(x)=\begin{cases}(x-a)\sin\dfrac{1}{(x-a)} & if\ x\neq a\\ 0 & if\ x=a\end{cases}$, discuss the continuity of f at x = a.

Q.2: (9,8)

(a) Find $\dfrac{dy}{dx}$, $if\ y=(\tan x)^{\cot x}+(\cot x)^{\tan x}$

(b) Find a root of equation sinx = 1– x with $x_0 = 0$ upto four decimal places by using Newton-Raphson method.

Q.3: (9,8)

(a) If $y=arc\ \tan x$, show that $(1+x^2)y''+2xy'=0$ hence find the value of $y^{(n)}$ when x = 0.

(b) If $f(x)=\sin^2 x\ on\ [0,\pi]$. Discuss the validity of Rolle's theorem. Find c if possible such that $f'(c)=0$.

Q.4: (9,8)

(a) Find the first four terms of the Maclaurin's series f(x) = ln(1 –x).

(b) Evaluate $\lim\limits_{x\to 0}(\tan x)^{\sin 2x}$

SECTION – II

Q.5: (9,8)

(a) Show that the pedal equation of the curve $x=2a\cos\theta-a\cos 2\theta,\ y=2a\sin\theta-a\sin 2\theta$ is $9(r^2-a^2)=8p^2$

(b) Find the points at which r = 1 + cosθ has vertical tangent.

Q.6: (9,8)

(a) Analyze and graph the conic represented by xy + x – 2y + 3 = 0

(b) Find the measure of the angle of intersection of the curves r = 1, r = 2sinθ

Q.7: (9,8)

(a) Find the shortest distance between the lines $\dfrac{x-3}{1}=\dfrac{y-5}{-2}=\dfrac{z-7}{1}$ and $\dfrac{x+1}{7}=\dfrac{y+1}{-6}=\dfrac{z+1}{1}$ and find equations of the st-lines perpendicular to both the given st-lines.

(b) Show that whether the lines; L; x+2y–1 = 0 = 2y–z–1 , M; x–y–1 = 0 = x–2z–3 are parallel or perpendicular or neither?

(P.T.O.)

Q.8:

(9,8)

(a) Find the point of intersection of lines $\frac{x-1}{2}=\frac{y+1}{-3}=\frac{z+10}{8}$ *and* $\frac{x-4}{1}=\frac{y+3}{-4}=\frac{z+1}{7}$ write the equation of the plane through them.

(b) Find an equation of the sphere passing through the points (0, −2, −4) , (2, −1, −1) and having its center on the st.line 2x − 3y = 0 = 5y + 2z

SECTION – III

Q.9:

(8,8)

(a) Sketch the graph of the limacon $r=3+4\cos\theta$

(b) Find the asymptotes of the curve $x^2y+xy^2+xy+y^2+3x=0$

Q.10:

(8,8)

(a) Prove that the intrinsic equation of the cycloid $x=a(\theta+\sin\theta)$, $y=a(1-\cos\theta)$ $is\ S = 4a\sin\alpha$

(b) Find the relative extrema of $f(x)=x^x$

SECTION – IV

Q.11:

(5,5,6)

Integrate the following.

(i) $\int\frac{\sec x dx}{1+\csc x}$

(ii) $\int\frac{dx}{(1+x^2)\sqrt{1-x^2}}$

(ii) $\int\frac{dx}{(x^2+4x+5)\sqrt{x+2}}$

Q.12:

(8,8)

(a) Prove that $\int_0^{\pi}\frac{x\sin x}{1+\sin x}dx=\frac{\pi^2}{2}-\pi$

(b) Obtain a reduction formula for $\int\frac{x^n}{\sqrt{1-x^2}}\,dx$ and hence evaluate $\int\frac{x^3}{\sqrt{1-x^2}}\,dx$

UNIVERSITY OF THE PUNJAB

B.A. / B.Sc. (Composite) Annual Exam – 2019

Subject: Mathematics A Course
PAPER: B

MAX. TIME: 3 Hr.
MAX. MARKS: 100

NOTE: Attempt SIX questions by selecting TWO questions from Section – I, ONE question from Section – II, ONE question from Section – III and TWO questions from Section – IV.

Section I

Q-1(a): If A and b are symmetric matrices, then prove that AB is symmetric if and only if A and B commute.

(b): Find the rank of the matrix $\begin{bmatrix} 1 & 3 & -2 & 5 & 4 \\ 1 & 4 & 1 & 3 & 5 \\ 1 & 4 & 2 & 4 & 3 \\ 2 & 7 & -3 & 6 & 13 \end{bmatrix}$ (9, 8)

Q-2(a): Without expanding prove that $\begin{vmatrix} a^2 & (a+1)^2 & (a+2)^2 & (a+3)^2 \\ b^2 & (b+1)^2 & (b+2)^2 & (b+3)^2 \\ c^2 & (c+1)^2 & (c+2)^2 & (c+3)^2 \\ d^2 & (d+1)^2 & (d+2)^2 & (d+3)^2 \end{vmatrix} = 0$

(b): Solve the system of equations by Gaussian elimination method: (9, 8)

$$x_1 - x_2 + 2x_3 = 0$$
$$4x_1 + x_2 + 2x_3 = 1$$
$$x_1 + x_2 + x_3 = -1$$

Q-3(a): Show that the sets of vectors generates $R^3\{(1,2,3),(0,1,2),(0,0,1)\}$

(b): Let U and W be 2-dimensional subspaces of R^3. Show that $U \cap W \neq \{0\}$ (9, 8)

Q-4(a): A linear transformation $T: U \to V$ is one-to-one if and only if $N(T) = \{0\}$ (9, 8)

(b): Find the matrix of linear transformation $T: R^3 \to R^4$ defined by $T(x_1, x_2, x_3) = (x_1 + x_2, x_2 + x_3, x_1 - x_3, x_1)$ with respect to the standard bases for R^3 and R^4.

Section II

Q-5(a): Show that $\{(1,-1,0),(2,-1,-2),(1,-1,-2)\}$ is a basis of R^3 . Find an orthonormal basis of R^3 using the Gram-Schmidt process.

(b): Find an orthogonal matrix whose first row is $(\frac{1}{\sqrt{5}}, \frac{2}{\sqrt{5}})$. (8, 8)

P.T.O.

Q-6(a): If λ is an eigenvalue of a nonsingular matrix A, then show that λ^{-1} is an eigenvalues.

(b): For symmetric matrix $A = \begin{bmatrix} 7 & 3 \\ 3 & -1 \end{bmatrix}$ find an orthogonal matrix, P for which $P^T AP$ is diagonal. (8, 8)

Section III

Q-7(a): Solve D.E. $(x^2 + 3y^2)dx - 2xydy = 0$ (8, 8)

(b): Solve D.E. $(ye^{xy}cos2x - 2e^{xy}sin2x + 2x)dx + (xe^{xy}cos2x - 3)dy = 0$

Q-8(a): Solve the initial value problem $e^x[y - 3(e^x + 1)^2]dx + (e^x + 1)dy = 0$ $y(0) = 4$

(b): Find the orthogonal trajectories of the curve of the family $r^n = a^n cosn\theta$ (8, 8)

Section IV

Q-9(a): Find the general solution of $(D^2 - 5D + 6)y = sin3x.$ (9, 8)

(b): Solve $x^2y'' + 2xy' - 6y = 10x^2$

Q-10(a): Find a general solution of $x^2\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2y = x^3e^x.$ (9, 8)

(b): Solve the D.E. $2x\frac{d^3y}{dx^3}\cdot\frac{d^2y}{dx^2} = (\frac{d^2y}{dx^2})^2 - a^2.$

Q-11: Compute: (6, 6, 5)

i. $\angle\{t^3e^{-t}\}$
ii. $\angle\{\cos(at + h)\}$
iii. $\angle^{-1}\left\{\frac{s-2}{s^2-2}\right\}$

Q-12(a): Solve the system of D.E (9, 8)

$$\frac{dx}{dt} + \frac{dy}{dt} + 2x + 6y = 2e^t$$

$$2\frac{dx}{dt} + 3\frac{dy}{dt} + 3x + 8y = -1$$

(b): Use the Lapace transform method to solve D.E.

$\frac{dy}{dt} + 4y = 2e^t - 4e^{-t}$ $y(0) = 0$

UNIVERSITY OF THE PUNJAB

B.A. / B.Sc. (Composite) Annual Exam – 2019

Subject: Mathematics B Course
PAPER: A

MAX. TIME: 3 Hr.
MAX. MARKS: 100

NOTE: Attempt SIX questions by selecting ONE question from section – I, TWO questions from section – II, TWO questions from section – III and ONE questions from section – IV.

Q1.

a. Prove that 8

$(\underline{a} \times \underline{b}) \times (\underline{c} \times \underline{d}) = \underline{a}.\underline{c}\times\underline{d}\ \underline{b} - \underline{b}\ .\ \underline{c}\times\underline{d}\ \underline{a}$

$= \underline{a}.\underline{b}\times\underline{d}\ \underline{c} - \underline{a}.\underline{b} \times \underline{c}\ \underline{d}$

b. If $\underline{f}$ is a vector function of t, prove that: $\frac{d}{dt}\left(\frac{\vec{f}}{|\vec{f}|}\right) = \frac{\vec{f}'\,\vec{f}.\vec{f} - \vec{f}\,\vec{f}.\vec{f}'}{(\vec{f}.\vec{f})^{\frac{3}{2}}}$ 8

Q2.

a. Evaluate the directional derivative of the function $\emptyset = x^2 - y^2 + 2z^2$ at the point P(1,2,3) in the direction of $\overrightarrow{PQ}$ where Q has the co-ordinates (5,0,4) 8

b. If $\vec{F} = e^{xy}\ \underline{i} + \sin(xy)\ \underline{j} + \text{Cos}\ (yz^2)\ \underline{k}$ then evaluate curl $\vec{F}$. 8

SECTION-III

Q3.

a. If two forces P and Q act at such an angle that their resultant R=P, show that if P is doubled, the new resultant is at right angles to Q. 8

b. Three forces P,Q,R act along the sides BC, CA, AB respectively of a triangle ABC. Prove that P Cos A + Q Cos B + R Cos C = 0 then the line of action of the resultant passes through the circumcentre of the triangle. 9

Q4

a. Two beads of weight w and w' can slide on a smooth circular wire in a particular plane. They are connected by a light string which subtends an angle 2β at the centre of the circle when the beads are in equilibrium on the upper half of the wire . Prove that the inclination $\propto$ of the string to the horizontal is given by $\tan \propto = \frac{w-w'}{w+w'} \tan \beta$. 9

b. A smooth circular cylinder of radius b is fixed parallel to a smooth vertical wall with its axis at a distance c from the wall. A smooth uniform heavy rod of length 2a rest on the cylinder with one end on the wall and in a plane perpendicular to the wall. Show that its inclination Θ to the horizontal is given by $a\ \text{Cos}^3\ \Theta + b \sin \Theta = c$ 8

Q5

a. The radius of the faces of a frustum of a solid cone are 2ft. and 3ft. and the height of the frustum is 4ft. Find the distance of the c.g. from the larger face. 9

b. Find the centroid of the arc of the curve $x^{2/3} + y^{2/3} = a^{2/3}$ lying in the first quadrant. 8

Q6.

a. Find the force necessary just to support a heavy particle on an inclined plane of inclination $\alpha\ (\alpha > \lambda)$. 8

b. A uniform ladder rests with its upper end against a smooth vertical wall and its foot on rough horizontal ground. Show that the force of friction at the ground is ½ W tan Θ, where W is the weight of the ladder and Θ is its inclination with the vertical 9

P.T.O.

SECTION-III

Q7

a. A particle is moving along the Parabola $x^2 = 4ay$ with constant speed v. Determine the tangential and the normal component of its acceleration when it reaches the point whose abscissa is $\sqrt{5}a$. 9

b. A point describes simple harmonic motion in such a way that its velocity and acceleration at a point P are u and f respectively and the corresponding quantities at another point Q are v and g. Find the distance PQ. 8

Q8

a. Prove that the force field $\vec{F} = (y^2 - 2xyz^3)\underline{i} + (3+2xy - x^2z^3)\underline{j} + (6z^3 - 3x^2yz^2)\underline{k}$
Is conservative, and determine its potential. 8

b. A ball is dropped from the top of a tower of height h. At the same moment, another ball is thrown from a point of the ground at a distance k from the foot of tower so as to strike the first ball at a depth d. Show that the initial speed and the direction of projection of the second ball are respectively

$\sqrt{\frac{g(h2+k2)}{2d}}$ $and\ tan^{-1}(\frac{h}{k})$ 9

Q9

a. The angular velocity of a particle about a point in its plane of motion is constant. Prove that the transverse component of its acceleration is proportional to the radial component of its velocity. 8

b. A shell bursts on contact with the ground and pieces from it fly in all directions with all speed up to 80 feet per second. Prove that a man 100 feet away is in danger for $5/\sqrt{2}$ seconds. 9

Q10.

a. A particle describes the curve under the force F to the pole
$r^n = A \cos n\Theta + B \sin n\Theta$; $F \propto \frac{1}{r^{2n+3}}$ 8

b. A planet is describing an ellipse about the sun as focus. Show that its velocity away from the sun is greatest when the radius vector to the planet is at right angles to the major axis of the path, and that it the n is $\frac{2\pi a e}{T(1-e^2)}$, where 2a is the major axis, e the eccentricity, and T is the periodic time. 9

SECTION- IV

Q11

a. A rubber ball drops from a height h and after rebounding twice from the ground, it reaches a height h/2. Find the co-efficient of restitution. What would be the co-efficient of restitution had the ball reached a height h/2 after rebounding three times? 8

b. An imperfectly elastic ball is projected with velocity $\sqrt{gh}$ at angle α with the horizon, so that it strikes a vertical wall distant c from the point of projection, and returns to the point of projection. Show that the coefficient of restitution between the ball and the wall is $\frac{c}{h \sin 2\alpha - c}$. 8

Q12

a. If two inelastic spheres have direct impact, there is the kinetic energy lost by the impact is that of a body whose mean is half the harmonic mean between those of the spheres and whose velocity equals their relative velocity before impact. 8

b. Two equal balls of elasticity e impinges having before impact resolved velocities u_1, v_1 in the direction of the common normal and u_2 v_2 perpendicular to it. If their motion after impact are at right angles, prove that $(u_1 + v_1)^2 + 4u_2v_2 = e^2 (u_1 - v_1)^2$ 8

UNIVERSITY OF THE PUNJAB

B.A. / B.Sc. (Composite) Annual Exam – 2019

Roll No. ....

Subject: Mathematics B Course
PAPER: B

MAX. TIME: 3 Hr.
MAX. MARKS: 100

NOTE: *Attempt SIX questions in all, selecitng TWO questions from Section I & II each and ONE question from Section III & IV each.*

SECTION I

Q -1 (a)If $\sin(\theta + i\varphi) = \cos\alpha + i\sin\alpha$,provesthat$\cos^2\theta = \pm\sin\alpha$.

(b) Prove thatcot$^{-1}h\left(\frac{2}{z}\right) = \sin^{-1}h\ \left(\frac{z}{\sqrt{4-z^2}}\right)$. (9, 8)

Q-2(a) If log sin (x+ iy) =u+iv show that $e^{2y} = \frac{\cos(x-v)}{\cos(x+v)}$ 9,8

(b) Find the direction of Qibla of Peshwar whose latitudeφ=34˚,1́N and longitude λ=71˚,40́E

Q.3(a) State and prove Euler theorem 9,8

(b) If$Z = \frac{\cos y}{x}, x = u^2 - v, y = e^v$ $find$ $\frac{\partial z}{\partial u}, \frac{\partial z}{\partial v}$.

Q.4 (a) Find the area bounded by the parabola $y = x^2$and the straight line $y = 2x + 3$

(b) Use the cylindrical coordinate to evaluate $I = \iiint z\sqrt{x^2 + y^2}\ dv$, S is the hemisphere $x^2 + y^2 + z^2 \leq 4, z \geq 0$ (9, 8)

SECTION II

Q5 (a) Test the series $\sum_1^\infty \frac{2}{\sqrt{n+1}}$

(b) Test the series $\sum_1^\infty n\left(\frac{\pi}{n}\right)^n$ (9, 8)

Q6 (a) Test the series for (i) absolute convergence (ii) conditional convergence (iii) divergence $\sum_1^\infty(-1)^{n-1} = \frac{n!}{(2n)!}$

(b) Find the volume bounded by the cylinder $x^2+y^2=4$ and the planes y+z=4 and z=0 9,8

Q7 (a) Evaluate $\iiint$ (x+2y+4z) dxdydz where s is defined by $1\leq x\leq 2$, $-1\leq y\leq 0$, $0\leq z\leq 3$

(b) Test the series for convergence or divergence $\sum_1^\infty\ \left(\frac{n}{1+n^3}\right)^n$ (9, 8)

Q8 (a) Find the area bounded by $x^2=4y$ and $8y=x^2+16$

(b) Evaluate$\int^4 \int^{8-y}$ dx dy(9, 8)

P.T.O.