Directorate of Distance Education

(B.R.A. Bihar University, Muzaffarpur)

T.D.C. 2nd Semester Examination

(Session 2012-13)

Sub:- Mathematics (Hons.) (Paper - II)

Model Papers

1. State and prove De Moivre's theorem.
2. Find the expansion of Sin x in ascending powers of x.
3. Find the expansion of Cos x in ascending powers of x.
4. State and prove Gregories theorem
5. Find the sum of sines of n angles in A.P.
6. Find the sum of cosines of n angle in A.P.
7. Solve $x^7 - 1 = 0$
8. If $\tan x = n \tan y$ find a series for x.
9. Prove that nth roots of Unity forms a series in G.P.
10. Solve $x^5 - 1 = 0$
11. If $(1+x)^n = p_0 + p_1 x + p_2 x^2 + \cdots$ then prove that

$$p_0 - p_2 + p_4 - \cdots = 2^{\frac{n}{2}} \cos \frac{n\pi}{4}$$

and $$p_1 - p_3 + p_5 - \cdots = 2^{\frac{n}{2}} \sin \frac{n\pi}{4}$$

(12) Prove that

$$(1-i)^n + (1+i)^n = 2^{\frac{n}{2}} \cos\frac{n\pi}{4}$$

(13) If

$$x_r = \cos\left(\frac{\pi}{2^r}\right) + i\sin\left(\frac{\pi}{2^r}\right)$$

then prove that

$$x_1 . x_2 . x_3 \ldots \infty = -1$$

(14) If $(a_1+ib_1)(a_2+ib_2)\ldots(a_n+ib_n) = A+iB$

then prove that

(i) $\tan^{-1}\frac{b_1}{a_1} + \tan^{-1}\frac{b_2}{a_2} \ldots + \tan^{-1}\frac{b_n}{a_n} = \tan^{-1}\frac{B}{A}$

(ii) $(a_1^2+b_1^2)(a_2^2+b_2^2)\ldots(a_n^2+b_n^2) = A^2+B^2$

(15) Expand

$(1-2x\cos\theta+x^2)$ in a series of powers of x when $|x|<1$

(16) Using Demoivers theorem solve $x^7+x^5+x^2+1=0$

(17) Sum the series

$$1+c\cos\alpha+c^2\cos 2\alpha + c^3\cos 3\alpha \ldots + n \text{ terms}$$

(18) Sum the series

$$\sin\alpha + \frac{1}{2}\sin 2\alpha + \frac{1}{2^2}\sin 3\alpha$$

(19) Sum the series to …

$$1+\frac{1}{2}\cos 2\theta + \frac{1}{2.4}\cos 4\theta + \frac{1.3}{2.4.6}\cos 6\theta - - - \infty$$

when $-\frac{\pi}{2} < \theta < \frac{\pi}{2}$

(2I) Sum the series

$$1 + \frac{\cos 40}{4} + \frac{\cos 80}{\lfloor 2} + \cdots \infty$$

L.P.P

(1) Explain general and matrix formulation of L.P.P

(II) Define convex set. Prove that intersection of two convex sets is a convex set

(III) Prove that a hyperplane is a convex set

(IV) Prove that a sphere is a convex set.

(5) Prove that the set of feasible solution of L.P.P is a convex set

(6) Solve graphically the following L.P.P

maximize $z = 3x_1 + 5x_2$

Subject to

$x_1 + 2x_2 \le 2000$

$x_1 + x_2 \le 1500$

$x_2 \le 600$

$x_1 \ge 0,\ x_2 \ge 0$

(2) Solve graphically the following L.P.P

Minimise $z = x_1 + x_2$

Subject to Constraints

$$x_1 + 2x_2 \leq 20$$
$$x_1 + x_2 \leq 15$$
$$x_1 \leq 6$$
$$x_1, x_2 \geq 0$$

Theory of equation

(1) State and prove fundamental theorem of algebra

(ii) Find the condition that the roots of the equation

$$x^4 + px^3 + qx^2 + rx + s = 0$$

should be in H.P.

(iii) Find the condition that the roots of the equation of the biquadratic

$$x^4 + px^3 + qx^2 + rx + s = 0$$

may be in G.P

(4) If α, β and γ be the roots of the equation $x^3 + px^2 + qx + r = 0$

then calculate

$$(\alpha^2+1)(\beta^2+1)(\gamma^2+1)$$

(5) If α, β, γ be the roots of the cubic $x^3 + px^2 + qx + r = 0$, find the value of the symmetric functions $\sum \frac{\beta}{\gamma} + \frac{\gamma}{\beta}$

(6) If α, β, γ are the roots of the equation $x^3 + px^2 + qx + r = 0$ find the value of

$$\sum \frac{\beta^2+\gamma^2}{\beta+\gamma}.$$

(7) Solve the equation $x^3 - 7x^2 + 36 = 0$ given that one root is double of another root.

(8) Prove that in equation with real coefficients irrational roots occur conjugate pairs.

(9) Prove that every equation of nth degree has n roots and no more.

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Sub:- Mathematics (Subsidiary & General) (Paper - II)

Model Papers

(1) State and prove De Moivre's theorem

(ii) Find the expansion of $\sin x$ in ascending powers of x

(iii) Find the expansion of $\cos x$ in ascending powers of x

(iv) State and prove Gregories theorem.

(v) Expand $\cos^{-1}(x+iy)$ in the form of $A+iB$

(6) If $\tan x = n \tan y$ then find a series for x.

(7) Solve

$x^5 - 1 = 0$

(8) Expand $\tan^{-1}(\alpha + i\beta)$ in the form of $A+iB$

(9) If $x_r = \cos\left(\frac{\pi}{2^r}\right) + i\sin\left(\frac{\pi}{2^r}\right)$ then prove that

$x_1 \cdot x_2 \cdot x_3 \cdots = -1$

(10) Solve
$x^4 - 1 = 0$

~~(11)~~ Real Analysis

(1) State and prove Cauchy's general principle of convergence

(11) Prove that every convergent sequence is bounded.

(111) State and prove Cauchy's root test

(4) D' Alembert's test

(5) State and prove ratio test

(6) Define continuity and differentiability of a function

(7) Prove that a function which is differentiable at a point must be continuous at that point. But the converse is not true.

(8) Show that the sequence (a_n) is not convergent where
$a_n = 1 + \frac{1}{2} + \frac{1}{3} + \cdots \cdots + \frac{1}{n}$.

(9) Establish the existence of the limit of the sequence (a_n) defined by $a_n = \sqrt[n]{n}$ and find the limit

(10) Test the series

$$\frac{1}{1\cdot2\cdot3} + \frac{3}{2\cdot3\cdot4} + \frac{5}{3\cdot4\cdot5} + \cdots$$

(11) Test whether the series whose general term is given by

$$\sqrt{x^4+1} - \sqrt{x^4-1}$$

(12) Examine the continuity and differentiability of the function defined by

$$f(x) = x^2 \sin\frac{1}{x}, \quad x \neq 0$$

$$f(0) = 0$$

at $x = 0$

Analytical Geometry of two-dimensions:

(I) Discuss the condition for orthogonal intersection of two circles

(II) standard equation ellipse, Parabola, Hyperbola.

(III) Find the condition that the line $lx + my + n = 0$ may touch the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

Analytical geometry of Three dimension :-

① If l, m, n be the direction cosine of a line prove that $l^2+m^2+n^2=1$

② Find the equation of a plane passing through three given non-collinear points

③ Find the angle between two straight lines whose direction cosines ~~are~~ are given

④ Prove that every first-degree equation in x, y, z represents a plane

⑤ Find the equation of a plane in normal form

⑥ Find the equation of the plane passing through the point $(2,-1,4)$ and perpendicular to the join of $(1,-2,5)$ and $(2,1,3)$

⑦ Find the equation of the plane in intercept form.

⑧ Prove that the straight lines whose direction cosines are given by

$2l+2m-n=0$ and

$mn+nl+lm=0$.