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Name.....

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FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION
JUNE 2009

CH 2K 401—ENGINEERING MATHEMATICS—IV

[Common to AI/CE/EC/EE/IC/ME/PE/PM]

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

I. (a) Is there an analytic function $f(z) = u + iv$ for which $v = e^{y/x}$?

(b) Find the bilinear transformation that maps 1, i and -1 of the z-plane onto 0, 1 and ∞ of the w-plane.

(c) Evaluate using Cauchy integral formula $\int_C \frac{z+1}{z^2+2z+4}\,dz$ where C is the circle $|z+1+i|=2$.

(d) Obtain the Taylor expansion of $f(z) = \frac{1-z}{z^2}$ in power of $(z-1)$.

(e) Find $P_3(x)$ using Rodrigule formula.

(f) Prove that $J_{-1/2}(x) = \sqrt{\frac{2}{\pi x}}\cos x$.

(g) Write down the possible solution of one dimensional wave equation $\frac{\partial^2 y}{\partial t^2} = a^2 \frac{\partial^2 z}{\partial x^2}$.

(h) Solve $2x\frac{\partial z}{\partial x} - 3y\frac{\partial z}{\partial y} = 0$ by method of separation of variables.

(8 × 5 = 40 marks)

II. (A) State and prove the C.R. equations of polar co-ordinates for an analytic function.

(15 marks)

Or

(B) (i) Find the transformation that maps the semi-infinite strip $-a < u < a$, $v \geq 0$. of the w-plane on to the upper half of the z-plane.

(8 marks)

Turn over

(ii) Find the Laurent's series about the point $z = 1$ for $f(z) = \frac{e^{2z}}{(z-1)^3}$.

III. (A) State and prove Cauchy Residue theorem. Also, evaluate $\int \frac{z-2}{z^2-z} dz$ where "C" is the circle $x^2 + y^2 = 4$.

Or

(B) State and prove Cauchy's integral formula. Also evaluate $\int_C \frac{e^{2z}}{(z+1)^4} dz$ where C is the circle $|z| = 2$.

IV. (A) Show that $\int_{-1}^{1} P_n^2(x)\, dx = \frac{2}{(2n+1)}$. $n = 0, 1, 2, \ldots$

(15 marks)

Or

(B) Solve $y'' - xy' + y = 0$ using infinite series method. (15 marks)

V. (A) Solve, by method of separation of variables, $4\frac{\partial z}{\partial x} + \frac{\partial y}{\partial y} = 3z$. Subject to $z = e^{-5y}$ when $x = 0$.

(15 marks)

Or

(B) A taut string of length $2l$ is fastened at both ends. The mid-point of the string is taken to a height "b" and then released from the rest in that position. Find the displacement of the string.

(15 marks)

[4 × 15 = 60 marks]