F.E Sem I Rev (CGS) 11/5/2013

Applied maths - I

D : PH (April Exam) 181

Con. 6865-13. **(REVISED COURSE)** **GS-5103**

(3 Hours) [**Total Marks : 80**

N.B. (1) Question No. 1 is **compulsory**.

(2) Attempt any **three** questions from Question Nos. 2 to Questions No. 6

(3) **Figures** to the **right** indicate **full** marks.

1. (a) If $\cosh x = \sec\theta$ prove that $x = \log(\sec\theta + \tan\theta)$. 3

(b) If $u = \log(x^2 + y^2)$, prove that $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$ 3

(c) If $x = r\cos\theta$, $y = r\sin\theta$. Find $\frac{\partial(x, y)}{\partial(r, \theta)}$. 3

(d) Expand $\log(1 + x + x^2 + x^3)$ in powers of x upto x^8. 3

(e) Show that every square matrix can be uniquelly expressed as sum of a symmetric and a Skew-symmetric matrix. 4

(f) Find n^{th} order derivative of 4

$y = \cos x. \cos 2x. \cos 3x.$

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2. (a) Solve the equation $x^6 - i = 0$. 6

(b) Reduce matrix A to normal form and find its rank where :– 6

$$A = \begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$$

(c) State and prove Euler's theorem for a homogeneous function in two variables and hence find $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ where $u = \frac{\sqrt{x} + \sqrt{y}}{x + y}$ 8

3. (a) Determine the values of λ so that the equations $x + y + z = 1$; $x + 2y + 4z = \lambda$; $x + 4y + 10z = \lambda^2$ have a solution and solve them completely in each case. 6

(b) Find the stationary values of 6

$x^3 + y^3 - 3axy, a > 0.$

(c) Separate into real and imagianary parts $\tan^{-1}(e^{i\theta})$. 8

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4. (a) If $x = u\cos v$, $y = u\sin v$ 6

Prove that $\dfrac{\partial(x,y)}{\partial(u,v)} \cdot \dfrac{\partial(u,v)}{\partial(x,y)} = 1$.

(b) If $\tan[\log(x+iy)] = a+ib$, prove that $\tan[\log(x^2+y^2)] = \dfrac{2a}{(1-a^2-b^2)}$ where $a^2+b^2 \neq 1$. 6

(c) Using Gauss-Siedel iteration method, solve 8

$$10x_1 + x_2 + x_3 = 12$$
$$2x_1 + 10x_2 + x_3 = 13$$
$$2x_1 + 2x_2 + 10x_3 = 14$$

upto three iterations.

5. (a) Expand $\sin^7\theta$ in a series of sines of multiples of θ. 6

(b) Evaluate $\lim\limits_{x\to 0} \dfrac{(x^x - x)}{(x-1-\log x)}$ 6

(c) If $y^{1/m} + y^{-1/m} = 2x$, prove that 8

$$(x^2-1)\,y_{n+2} + (2n+1)\,xy_{n+1} + (n^2-m^2)\,y_n = 0.$$

6. (a) Examine the following vectors for linear dependence/Independence. 6

$X_1 = (a, b, c)$, $X_2 = (b, c, a)$, $X_3 = (c, a, b)$ where $a+b+c \neq 0$.

(b) If $z = f(x, y)$, $x = e^u + e^{-v}$, $y = e^{-u} - e^v$, prove that 6

$$\frac{\partial z}{\partial u} - \frac{\partial z}{\partial v} = x\frac{\partial z}{\partial x} - y\frac{\partial z}{\partial y}$$

(c) Fit a straight line to the following data and estimate the production in the year 1957. 8

Year :	1951	1961	1971	1981	1991
Production in the Thousand tons :	10	12	08	10	13
