Total No. of Printed Pages:3

SUBJECT CODE NO: E-182
FACULTY OF ENGINEERING AND TECHNOLOGY
F.E.(All) (CGPA) Examination Nov/Dec 2017
Engineering Mathematics - I
(REVISED)

[Time: Three Hours] **[Max.Marks:80]**

Please check whether you have got the right question paper.

N.B
i. Use of non-programmable calculator is allowed
ii. Q.No.1 & Q.No.6 are compulsory
iii. Solve any two question from Q.No.2,3,4,and 5
iv. Solve any two question from Q.No.7,8,9and 10

Section A

Q.1 Attempt the following(Any five) 10

a) Define normal form of matrix

b) State Cayley-Hamilton's theorem.

c) Show the matrix $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ is orthogonal.

d) Define Eigen values and Eigen vectors

e) Define modules and amplitude of complex number.

f) Find locus $Z\ if\ |Z - i|\ = 4$

g) State De-Moivre's theorem.

h) Find general value of log(-5)

Q.2

a) Find ranks of matrix A by reducing it to its normal form A=$\begin{bmatrix} 0 & 1 & 2 & -2 \\ 4 & 0 & 2 & 6 \\ 2 & 1 & 3 & 1 \end{bmatrix}$ 05

b) Find Eigen values and Eigen vector corresponding largest Eigen value of following matrix A=$\begin{bmatrix} 2 & 1 & 1 \\ 2 & 3 & 2 \\ 3 & 3 & 4 \end{bmatrix}$ 05

c) The centre of regular hexagon is at origin and vector is 1+ i on Argrand's diagram, determine the other vertices. 05

Q.3	a)	Test for consistency and solve if possible the following system of equations $x + 2y - z = 3, 3x - y + 2z = 1, 2x - 2y + 3z = 2$	05
	b)	Verify Cayley-Hamilton theorem and find inverse A= $\begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$	05
	c)	Show that all roots of equation $(x+1)^6 + (x-1)^6 = 0$ $are\ given\ by \mp icot\ \frac{2r+1}{12}\pi\ where.r = 0,1,2,3$	05
Q.4	a)	Examine for linear dependence or liner independence and find relation if dependence the following set of vectors. [3,2,7], [2,4,1], [1,-2,6]	05
	b)	Separate real and imaginary parts of $\cos^{-1}[\frac{3i}{4}]$	05
	c)	Use De-Moivre's theorem to express $\tan 5\theta$ is terms of power of $\tan\theta$ and deduce $5\tan^4\frac{\pi}{10} - 10\tan^2\frac{\pi}{10} + 1 = 0$	05
Q.5	a)	Given the transformation $Y = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 5 \\ 1 & 3 & 3 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$ find co-ordinates $[x_1\ x_2\ x_3]$ to (2,0,5) in y.	05
	b)	If $\tan(a + i\beta) = i, \alpha, \beta$ being real, prove that α is indeterminate and β is infinite.	05
	c)	Considering principle value, separate $\sqrt{i}^{\sqrt{i}}$ into real and imaginary parts.	05

Section B

Q.6		Attempt the following (Any five)	10
	a)	Find n^th order derivative of $y = (x+1)^m$	
	b)	Derive series for coshx	
	c)	State Cauchy's root test for convergence of a power series	
	d)	State Maclaurin's theorem and derive series for tanx	
	e)	Find Jacobian $if\ u = e^x\ siny, v = x + \log\ siny$	
	f)	Find stationary value of function $z^z = xy + 1$	
	g)	If $u = \sin\sqrt{\frac{x-y}{x+y}}\ prove\ that\ x\frac{du}{dx} + y\frac{du}{dy} = 0$	
	h)	Evaluate $lim_{x\to 0}(\cot x)^{\sin x}$	

Q.7	a) Find the n[th] derivative of $\frac{1}{x^2+x+1}$	05
	b) If $u = log_e\left(\frac{x^4+y^4}{x+y}\right) show\ that\ x\frac{du}{dx} + y\frac{du}{dy} = 3$	05
	c) Find $\frac{dy}{dx} = if\ y^x + x^y = (x+y)^{(x+y)}$	05
Q.8	a) Find $lim_{x\rightarrow 0}(a^x + x)^{\frac{2}{x}}$	05
	b) If $u = \frac{yz}{x}, v = \frac{xz}{y}, w = \frac{xy}{z}\ find\ \frac{d(u,v,w)}{d(x,y,z)}$	05
	c) If $u = \frac{e^{x+y+z}}{e^x+e^y+e^z}$ show that $u_x + u_y + u_z = 2_u$	05
Q.9	a) Prove that the log $\left(\frac{\sin x}{x}\right) = -\frac{1}{6}x^2 - \frac{1}{180}x^4$ … … …	05
	b) Obtain the expansion of $tan^{-1}x\ is\ powers\ of\ (x-1)$	05
	c) If $x + y = 2e^{\theta}\cos\emptyset\ and\ x - y = 2ie^{\theta}\ \sin\emptyset\ show\ that\ \frac{\partial^2 u}{\partial\theta^2} + \frac{\partial^2 u}{\partial\emptyset^2} = 4xy\frac{\partial^2 u}{\partial x\partial y}$.	05
Q.10	a) Prove that $sin^{-1}(3x - 4x^3) = 3(x + \frac{1}{6}x^3 + \frac{3}{40}x^5 + \cdots)$	05
	b) Test for convergence or divergence of $\sum\frac{3^n n!}{n^n}$	05
	c) A rectangular box is open at top is to have volume of 32 cu. feet. Find the dimensions of the box requiting least martial for its construction.	05