Total No. of Printed Pages:2

SUBJECT CODE NO:- P-2
FACULTY OF ENGINEERING AND TECHNOLOGY
F. E. (All) (CGPA) Examination May/June 2017
Engineering Mathematics - I
(Revised)

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

Please check whether you have got the right question paper.

N.B
i) Q.No.1 and Q.No.6 are compulsory.
ii) Solve any two questions from Q.Nos. 2, 3, 4 and 5.
iii) Solve any two questions from Q.Nos. 7, 8, 9 and 10.

Section A

Q.1 Attempt the following (Any five). 10

a. Define the rank of matrix.
b. For A=$\begin{pmatrix}1 & 1\\ 2 & 3\end{pmatrix}$, find A^{-1}
c. Check the linear independence and dependence for the vectors (1,2,3),(2,-2,6).
d. Find the characteristics roots of the matrix $\begin{pmatrix}1 & 0\\ 0 & 4\end{pmatrix}$
e. Find the locus of Z if|z|=3.
f. If z=tan α +i,find |z| and ampz.
g. If $\cos(\alpha + i\beta)$ =x+iy then prove that $\frac{x^2}{\cos^2\alpha}$ - $\frac{y^2}{\sin^2\alpha}$=1
h. Find the value of $\frac{(cos\theta+isin\theta)^5(cos4\theta-isin4\theta)^4}{(cos3\theta+isin3\theta)^{-5}(cos2\theta-isin2\theta)^{-5}}$

Q.2 A

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

b)Find the Eigen values and corresponding Eigen vectors for the largest Eigen value of the matrix $\begin{bmatrix}-2 & 2 & -3\\ 2 & 1 & -6\\ -1 & -2 & 0\end{bmatrix}$ 05

c)If z_1 &z_2 are any two complex numbers such that [z_1+z_2]=[z_1-z_2], prove that the difference of their amplitude is $\frac{\pi}{2}$. 05

Q.3 a) Find the values of a and b if the following system has i) No solution, ii) Unique Solution, iii) Infinitely many solution x+y+z=6; x+2y+3z=10; x+2y+az=b. 05

b) State cayley- Hamilton theorem and verify it for the matrix $\begin{bmatrix}2 & -1 & 1\\ -1 & 2 & -1\\ 1 & -1 & 2\end{bmatrix}$ 05

c) Show that the continued product of all the values of $(1+i)^{\frac{1}{5}}$ is 1+i 05

Q.4
a. Solve x+y+3z=0; x+y+z=0; -x+2z=0. 05
b. If $\cos\left(\frac{\pi}{4}+ia\right)\cos h\left(b+i\frac{\pi}{4}\right)=1$, a and b are real numbers then show that 2b=$\pm\log(2+\sqrt{3})$ 05
c. Separate sec(x+iy) into real and imaginary parts. 05

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Q.5 a) Find the inverse transformation of $x_1=y_1+2y_2+5y_3$; $x_2=-y_2+2y_3$; $x_3=2y_1+4y_2+11y_3$ 05

b) If tan(x+iy)=sin(u+iv) then prove that $\frac{\tan u}{\tanh v}=\frac{\sin 2x}{\sinh 2y}$ 05

c) Prove that $\cos\left[ilog\left(\frac{a-ib}{a+ib}\right)\right] = \frac{a^2-b^2}{a^2+b^2}$ 05

Section B

Q.6 Attempt the following (Any five). 10

a. If $y=\frac{1}{x^2-1}$ then find y_n

b. Derive the series for sinh 2x.

c. Evaluate $\lim_{x\to 0} x^x$.

d. State the Cauchy's root test.

e. If $u=x^2+y^2$ where x=sint, y=cost then find $\frac{du}{dt}$.

f. If $u=\frac{x^3y^3z^3}{x^2+y^2+z^2}$ then find $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}$.

g. If x =r $\cos\theta, y = rsin\theta$ *then find* J.

h. Find the stationary points of the function $f(x,y)=x^2+y^2-2ax$.

Q.7 a) IF $y=e^{3x}\sin 3x \cos x$ then find y_n. 05

b) If $z=f(x+2y)+\Phi\,(x-2y)$ *then prove that* $\frac{\partial^2 z}{\partial y^2}=4\frac{\partial^2 z}{\partial x^2}$ 05

c) If x=2(u+v), y=2(u-v) and $u=r^2\cos 2\theta, v = r^2 \sin 2\theta, v = r^2\sin 2\theta$ *then find* $\frac{\partial(x,y)}{\partial(r,\theta)}$ 05

Q.8

a. Evaluate $\lim_{x\to 0}\left(\frac{2^x+3^x+4^x}{3}\right)^{\frac{1}{x}}$ 05

b. Show that JJ' = 1 if $x=e^v \sec u$, $y=e^v \tan u$. 05

c. If $u=\sin^{-1}\sqrt{x^2+y^2}$ then find $x^2u_{xx}+2xyu_{xy}+y^2u_{yy}$. 05

Q.9 a. Expand logx in powers of (x-3). 05

b. Prove that $(1+x)^x=1+x^2-\frac{x^3}{2}$---------------- 05

c. If $z=f(u,v), u=x^2+y^2$, v=2xy then show that $x\frac{\partial z}{\partial x}-y\frac{\partial z}{\partial y}=2\sqrt{u^2-v^2}\frac{\partial z}{\partial u}$ 05

Q.10 a. Expand sinh x in ascending powers of x. 05

b. Test the convergences of $\sum_{n=1}^{\infty}\frac{n!}{4^n}$ 05

c. A rectangular box open at the top is to have volume of 256 cubic feet, determine the dimensions of the box required least. 05

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