(Please write your Exam Roll No.) Exam Roll No. ....

END TERM EXAMINATION

SECOND SEMESTER [B.TECH] MAY-JUNE 2017

Paper Code: ETMA 102 **Subject: Applied Mathematics-II**

(Batch 2013 onwards)

Time: 3 Hours **Maximum Marks: 75**

Note: Attempt any five questions including Q.No. 1 which is compulsory. Select one question from each unit.

Q1. a) If u= log $(x^3+y^3+z^3-3xyz)$, show that

$$\left(\frac{\partial}{\partial x}+\frac{\partial}{\partial y}+\frac{\partial}{\partial z}\right)^2 u=\frac{-9}{(x+y+z)^2}.$$ **(5)**

b) Using Cauchy-Riemann equations, show that the function $f(z)=z^3$ is analytic in entire z-plane. **(5)**

c) Define impulse function and hence obtain its Laplace transform. **(5)**

d) Calculate the volume of the solid bounded by the surface x=0, y=0, lx+my+nz=1 and z=0. **(5)**

e) Solve the partial differential equation by Charpit's method. **(5)**
$(p^2+q^2)y=qz$.

Unit-I

Q2. a) Expand $f(x,y)= x^2y +3y-2$ in powers of x -1 and y+ 2 using Taylor's expansion. **(6.5)**

b) If x+ y+z= u, y+z=uv, z= uvw, show that **(6)**
$$\frac{\partial(x,y,z)}{\partial(u,v,w)}=u^2v.$$

Q3. a) A rectangular box, which is open at the top has a capacity of 256 cubic feet. Applying Lagrange's method of undetermined multipliers determine the dimensions of the box such that the least material is required for the construction of the box. **(6.5)**

b) If z= f(x,y) where x= e^u cos v and y= e^u sin v, show that
$$y\frac{\partial z}{\partial u}+x\frac{\partial z}{\partial v}=e^{2u}\frac{\partial z}{\partial y}.$$ **(6)**

Unit-II

Q4. a) Find the inverse Laplace transform of $\frac{s+4}{s(s-1)(s^2+4)}$. **(6.5)**

b) Find the Laplace transform of unit step function u(t-a), also find the Laplace transform of $t^2u(t-3)$. **(6)**

Q5. a) Using Laplace transform solve the following differential equation. **(6.5)**

$y''+2y'+2y= 5 \sin t$, where $y(0)= y'(0) =0$.

b) Evaluate, using Laplace transform **(6)**

i) $\int_0^\infty te^{-3t} \sin t\,dt$.

ii) $\int_0^\infty \frac{\sin t}{t}\,dt$.

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Unit-III

Q6. a) Find the image of $|z|=1$ under the transformation $\omega=\frac{i-z}{i+z}$, onto the w plane. (6.5)

b) Show that the function $z|z|$ is not analytic anywhere. (6)

Q7. a) Expand

$$f(z)=\frac{1}{(z-1)(z-2)}, 1<|z|<2.$$ (6.5)

b) Using contour integration in complex plane evaluate (6)

$$\int_0^{\pi}\frac{d\theta}{3+2\cos\theta}.$$

Unit-IV

Q8. a) Evaluate $\iint(x^2+y^2)dxdy$ throughout the area enclosed by the curves $y=4x$, $x+y=3$, $y=0$ and $y=2$. (6.5)

b) Use Green's theorem to evaluate. (6)

$\int_C (x^2+xy)dx+(x^2+y^2)dy$ where C is the square formed by the lines $y=\pm1$, $x=\pm1$.

Q9. a) Apply Stoke's theorem to calculate $\int_C 4ydx+2zdy+6ydz$, where C is the curve of integration $x^2+y^2+z^2=6z$ and $z=x+3$. (6.5)

b) If a force $\vec{F}=2x^2yi+3xyj$ displaces in the xy-place from (0,0) to (1,4) along the curve $y=4x^2$, find the work done. (6)

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ETMA-102

P2/2