Graphic Era HILL UNIVERSITY

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University under section 2(f) of UGC Act, 1956

GEHU/04M/9.1.3

Term Evaluation (Even) Semester Examination June 2025

Roll no. 2494027

Name of the Course: B.Tech.(All) | Semester: II
Name of Subject: Engineering Mathematics II | Course Code: **TMA 201**
Time: 3:00 hours | **Maximum Marks: 100**

Note:

(i) All questions are compulsory.
(ii) Answer any two sub parts of a question among *a*, *b* & *c*.
(iii) Total marks of each question are **twenty**.
(iv) Each sub part of a question carries **ten** marks.

Q1. $(10\times 2=20)$ Marks CO:1

a. Test the convergency of the series: $1+\frac{1}{2^2}+\frac{2^2}{3^3}+\frac{3^3}{4^4}+\frac{4^4}{5^5}\ldots$

b. Test the convergence of the series: $1+x+\frac{x.(x+1)}{1.2}+\frac{x.(x+1)(x+2)}{1.2.3}+\ldots$

c. Define Ratio test, Radical test, Rabbe's test and p-series test

Q2. $(10\times 2=20)$ Marks CO:2

a. Solve $(xy^2+x)dx+(yx^2+y)dy=0$.

b. Solve by the method of variation of parameters $\frac{d^2y}{dx^2}-y=\frac{2}{1+e^x}$.

c. Solve the given Cauchy Euler differential equation $x^2\frac{d^2y}{dx^2}-2x\frac{dy}{dx}-4y=x^4$.

Q3. $(10\times 2=20)$ Marks CO:3

a. Prove: $xJ_n'=nJ_n-xJ_{n+1}$

b. Show that: $(n+1)P_{n+1}=(2n+1)xP_n-nP_{n-1},\ n\geq 1$

c. Prove that $\int_{-1}^{1}P_m(x)P_n(x)\,dx=0$, if $m\neq n$.

Q4. $(10\times 2=20)$ Marks CO:4

a. If $u-v=(x-y)(x^2+4xy+y^2)$ and $f(z)=u+iv$ is an analytic function of $z=x+iy$ find $f(z)$ in term of z.

b. Prove that $u=x^2-y^2-2xy-2x+3y$ is harmonic. Find a function v such that $f(z)=u+iv$ is analytic. Also express $f(z)$ in terms of z.

c. Find the bilinear transformation which maps the points $1, i, -1$ onto the points $0, 1, \infty$. Also, show that the transformation maps the interior of the unit circle of the z-plane onto the upper half of the w plane.

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Q5. $(10\times 2=20)$ Marks CO:5

a. Evaluate $\int_C \frac{e^{i\pi z}}{2z^2-5z+2}dz$, where C is the unit circle $|z|=1$.

b. Use Cauchy's integral formula to evaluate $\int_C \frac{\sin \pi z^2+\cos \pi z^2}{(z-1)(z-2)}dz$ where C is the circle $|z|=3$.

c. Find the Laurent expansion for $f(z)=\frac{7z-2}{z^3-z^2-2z}$ in the region $1<|z+1|<3$.