PURBANCHAL UNIVERSITY

Time-bound Home Exam 2020

B.E. (Civil, Computer/E&C/Electrical)/Third Semester/*Final*

Time: 03:00 hrs. (+2 Hrs. for Submission) Full Marks: 80 /Pass Marks: 32

BEG201SH: Mathematics-III *(New Course)*

Instructions:

Dear Students!

- *This model of examination is for you as the end of your current semester. This examination allows you to write answer from your own place of residence. Follow the following instructions without fail.*
- *Do not write your name in the answer-sheet(s)*
- *All the answer-sheets should be sent to college through your approved email in which you have received your question paper.*
- *Do not write questions in the answer-sheet but mention clearly the question number.*
- *All the scan/photos of answer-sheets should be clearly visible. Any blur scan/photo will not be considered for evaluation. Responsibility lies with the students to make sure that scan/photos of the answer-sheet are of readable quality.*
- *Leave 1 inch margin on each side of the answer-sheet.*
- *Clearly mention your Roll no, subject, program, semester, page number at the right-top of each page as instructed by the Office of the Examination Management.*
- *Make sure that you send your answer-sheets within the given time. Any email received after the given time will not be acceptable.*
- *You are strictly advised to write with your own handwriting and that you are not using any unfair means to answer the questions.*
- *Do not consult during the examination period to any other person in answering the questions.*
- *Do not post any pictures of taking examination or your answer-sheets in any social-media. Found that may be taken action from University.*

The figures in the margin indicate full marks.

Group A

Answer FIVE questions. **5×5=25**

1. Define the Hermitian matrix and skew Hermitian matrix. If A is a skew Hermitian matrix then prove that iA is Hermitian.

2. Prove that $\begin{vmatrix} x & x^2 & yz \\ y & y^2 & zx \\ z & z^2 & xy \end{vmatrix} = (x-y)(y-z)(z-x)(xy+yz+zx)$

3. Solve by Gauss elimination method.

$$x+y+z=3$$
$$x-y+z=2$$
$$2x-y+3z=9$$

4. Define inverse of a matrix. Find the inverse of $\begin{bmatrix} 1 & 1 & 2 \\ 1 & 9 & 3 \\ 1 & 4 & 2 \end{bmatrix}$

5. Find eigen values and eigen vectors of the following matrix: $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$.

6. Find the rank of matrix A= $\begin{bmatrix} 4 & 1 & 2 & 1 \\ 1 & 2 & 1 & 3 \\ 3 & -1 & 1 & 2 \\ 1 & 2 & 0 & 1 \end{bmatrix}$ by reducing normal form.

Group B

Answer TWO questions. **2×10=20**

7(a) State and prove the Existence Theorem of Laplace transform.

(b) Find the Laplace transform of

(a) $f(t)=\sinh^3 t$ (b) $f(t)=\dfrac{1-\cos t}{t}$

8(a) Find the inverse Laplace transform of

(a) $\dfrac{s+2}{(s^2+4s+5)^2}$ (b) $\dfrac{1}{(s-2)(s+2)^2}$.

(b) Use convolution theorem to evaluate $L^{-1}\left\{\dfrac{1}{s^2(s^2+a^2)}\right\}$.

9. Solve the initial value problem by Laplace transform method: $\dfrac{d^2y}{dx^2}-3\dfrac{dy}{dx}+2y=e^{-x}$ $y(0)=2,\ y'(0)=-1$

Group C

Answer FIVE questions. **5×5=25**

10. Prove that the line integral $\int_C \vec{F}\,.\overrightarrow{dr}$ of a continuous vector function $\vec{F}$ defined in a region R is independent of path joining any two points in R if there exists a single valued scalar function ϕ having first order partial derivatives such that $\vec{F} = \nabla\phi$.

11. Find $\iint_S \vec{F}.\hat{n}ds$, where $\vec{F}=18z\vec{i}-6\vec{j}+12\vec{k}$ and S is the surface of the plane 2x+3y+6z=12 in the first octant.

12. State Dritchlet's theorem and find the volume of $\dfrac{x^2}{a^2}+\dfrac{y^2}{b^2}+\dfrac{z^4}{c^4}=1$ by Dritchlet's theorem.

13. State and prove the Green's Theorem in the plane.

14. Verify the Stoke's theorem for $\vec{F}=(2x-y)\vec{i}-yz^2\vec{j}-y^2z\vec{k}$ where s is the upper part of the sphere $x^2+y^2+z^2=a^2$ and C is its boundary.

15. Veryfy Gauss's divergence theorem for

$\iint_S (\vec{F}.\hat{n})ds$, where $\vec{F}=(2xy+z)\vec{i}+y^2\vec{j}-(x+3y)\vec{k}$ and S is the surface bounded by the planes x=0, y=0, z=0 2x+2y+z=6.

Group D

Answer TWO questions. **2×5=10**

16. Find the Fourier series of the function $f(x)=x\sin x$ in the interval $-\pi\le x\le\pi$.

17. Find the Fourier series for the function $f(x)=2x-x^2$ in the interval (0,2).

18. Find the Fourier series of $f(x)=e^{-x}$ in (-1,1) complex form.