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International Islamic University Chittagong
Department of Electrical and Electronic Engineering

Final Examination Autumn-2018 Program: B.Sc. Engg. (EEE)
Course Code: MATH-2309 Course Title: Mathematics-III
Time: 2 hours 30 minutes Full Marks: 50

Part A

[Answer any ***two*** questions from the followings; figures in the right margin indicate full marks.]

1(a). Find the Characteristic polynomial, Eigen values and Eigen vector for the following matrix $A=\begin{pmatrix}1 & 3\\ 2 & 4\end{pmatrix}$ **03**

1(b). Let $A=\begin{pmatrix}1-3i & 5+8i\\ -3 & 3-7i\\ -6-i & 5i\end{pmatrix}$ then find A^H. **03**

1(c). If $A=\begin{pmatrix}3 & 2\\ 2 & 1\end{pmatrix}$, then find A^3 and A^{-1}. **04**

2(a). State Cayley Hamilton'stheorem. Verify Cayley Hamilton's theorem for the matrix $A=\begin{bmatrix}1 & 2 & 0\\ 2 & -1 & 0\\ 0 & 0 & -1\end{bmatrix}$. Also find A^{-1} **06**

2(b). Define Eigen value and Eigen vectors. Find the Eigen value and corresponding Eigen vectors of the matrix $A=\begin{pmatrix}2 & \sqrt{2}\\ \sqrt{2} & 1\end{pmatrix}$ **04**

3(a). What is canonical form of a matrix? Construct the matrix $A=\begin{pmatrix}1 & 1 & 1 & -1\\ 1 & 2 & 3 & 4\\ 3 & 4 & 5 & 2\end{pmatrix}$ to canonical form and find its rank. **03**

3(b). Define diagonalization of matrices. Diagonalize the matrix $A=\begin{pmatrix}5 & 4\\ 1 & 2\end{pmatrix}$ **05**

3(c). What is orthogonal matrix? If A is orthogonal matrix then show that A^{-1} is also orthogonal. **02**

Part B

[Answer any ***three*** questions from the followings; figures in the right margin indicate full marks.]

4(a). Find the area of the triangle having vertices at $P(1,3,2)$, $Q(2,-1,1)$ and $R(-1,2,3)$ **03**

4(b). If $\vec{A}=a_1\hat{i}+a_2\hat{j}+a_3\hat{k}$, $\vec{B}=b_1\hat{i}+b_2\hat{j}+c_3\hat{k}$ and $\vec{C}=c_1\hat{i}+c_2\hat{j}+c_3\hat{k}$, then Show that **03**

$$\vec{A}.(\vec{B}\times\vec{C}) = \begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix}$$ and then Prove that $\vec{A}.(\vec{B}\times\vec{C}) = \vec{B}.(\vec{C}\times\vec{A}) = \vec{C}.(\vec{A}\times\vec{B})$

4(c). Prove that the law of ***sine's angle*** for a plane triangle by using vector. **04**

5(a). Illustrate the physical significance of Gradient, Divergence and Curl. **04**

Prove that $\nabla^2(\frac{1}{r}) = 0$

5(b). If $\boldsymbol{F} = (3xy^2)\boldsymbol{i} - y^2\boldsymbol{j}$, evaluate $\int_C \boldsymbol{F.dr}$ where C is the curve in the xy plane , $y = 8x^2$,from (0,0) to (1.2) **03**

5(c). A fluid motion is given by **V**=(x+y+az)**i**+(bx+3y-z)**j**+(3x+cy+z) for what value of a,b,c the motion is irrotational? **03**

6(a). State Green's theorem. Verify Green's theorem in [illegible] $\oint_C (xy + y^2)\,dx + x^2dy$ where C is the closed curve [illegible]ded by $y = x$ and $y = 8x^2$. **05**

6(b). Prove that [illegible]inates system is orthogonal. **03**

6(c). Apply [illegible] theorem to evaluate $\iint_S \boldsymbol{u.n}ds$,where s is the surface of the cylinder $x^2 +$ [illegible] $= a^2$ bounded by the planes z=0,z=h and where **u**=**i**x-**j**y-**k**z. **02**

7(a). What is solenoidial? Justify the vector **V**=(x+3y)**i**+(y-2z)**j**+(x-2z)**k** besolenoidial . **03**

7(b). **04**

If $\boldsymbol{A} =$ [illegible]

C. (i)The straight line from (0,0,0) to (1,0,0), then to (1,1,0) , [illegible] to (1,1,1) ,(ii) straight line joining (0,0,0) and (1,1,1).

7(c). If $\varphi = 2xyz^2$,**F**=xy**i**-z**j**+x^2**k**and C is the curve x=t^2,y=2t,z=t^3 from t=0 to t=1,eval[illegible] line integrals $\int_C \boldsymbol{F} \times \boldsymbol{dr}$