FIRST SEMESTER MSC MATHEMATICS ASSIGNMENT QUESTIONS

Differential Equations (MM213)

Assignment Questions

1)Find the general solution of $(2x^2+2x)y''+(1+5x)y'+y=0$ at $x=0$

2) Determine the nature of the point $x=\infty$ forLegender's equation

$(1-x^2)y''-2xy'+p(p+1)y=0$

3) Prove that $j_{1/2}(x)=\sqrt{(2/\pi x)}\cos x$

4) Eliminate the arbitrary function F from the equation and find the corresponding pde of $z=x+y+F(x,y)$

5) Find the general integral ofyzp+xzq=x+y

6) Solve by Charpits method $x^2p^2+y^2q^2=4$

7)Find the indical equation and its roots for the differential equation

$X^2y''+Xy'+(x^2-1)y=0$

8 Reduce $U_{xx}-x^2U_{yy}=0$ to a canonical form.

TOPOLOGY - 1 (MM214)

1. Suppose X is a metric space , A and B are subsets of X then
a)Prove that $\overline{A \cup B} = \bar{A} \cup \bar{B}$
b)Prove that $\overline{A \cap B} = \bar{A} \cap \bar{B}$

2. Verify that Z is nowhere dense in R

3. Verify that Q is first category in R

4. Suppose X is a metric space . Then prove that the following are quivalent

a) X is second countable.

b) X is separable.

c)X is Lindelof.

5. Prove that any open interval (a b) is homomorphic (0 1)

6. Prove that if X and Y are topological spaces and $A \subset X$ and $f : X \to Y$ is continuous then $\frac{f}{A} : A \to Y$ is continuous when A has the subspace topology. Prove the coverse of the result is not true.

7. If a space X is connected and locally pathwise connected , prove that X is pathwise connected.

8. Show that a space is T_2 if and only ifevery point of the intersection of its closed neighborhoods.

Linear Algebra (MM 211)

1) Suppose $a$and b real numbers, but not both 0. Find real numbers c and d such that $^1/_{a+bi}$ $=c+id$

2) Prove that $-(-v) = v$ for every $v \in V$

3) For each of the following subsets of F^3,determine whether it is a subspace of F^3

a)$\{(x_{1,}x_{2,}x_{3,}) \in F^3 : x_{1,} + 2x_{2,} + 3x_{3,} = 0\}$

b) $\{(x_{1,}x_{2,}x_{3,}) \in F^3 : x_{1,} + 2x_{2,} + 3x_{3,} = 4\}$

c) $\{(x_{1,}x_{2,}x_{3,}) \in F^3 : x_{1,}x_2x_{3,} = 0\}$

4) Suppose U and W are subspaces of R^8such that dim=3 and dim W=5 and U+W=R^8. $Prove$ that $U \cap W = \{0\}$

5) Prove that if T is linear map from F^4 toF^2 such that

Null T=$\{(x_1,x_2,x_3,x_4) \in F^3 : x_1 = 5x_2, and\ \ x_3, = 7x_4\}$,then T is surjective.

6) Define $T \in L(F^3)$ by $T(z_1,z_2,z_3,) = (2z_1,, 0{,}5z_3,)$. Find all eigen values and eigen vectors of T

Suppose Tis a linear map onV.Let$\{u_1, \dots \dots u_n,\}\ and \{v_1, \dots \dots v_n,\}$be basis of V.Show that

$$M\left(T, (\{u_1, \dots \dots u_n,\})\right) = A^{-1} M\left(T, (\{v_1, \dots \dots v_n,\})\right) A$$

7) Prove that $det(AB) = \det A . \det B$

Real Analysis –I (MM 212)

1) Define bounded variation and total variation of a function
2) Show that $V(x) = V_f(a, x)$ is continuous,if$f$ is continuous.
3) Define rectifiable path and prove that$\Lambda_f(a, b) = \Lambda_f(a, c) + \Lambda_f(c, b)$
4) Define Riemann-Stietljes integral and state and prove integration by parts.
5) State and Eulers Summation formula
6) State and prove Riemann condition for integrability
7) If $f \in R(\alpha)\ then\ \ show\ that\ f \in R(V)$
8) Define uniform convergence of a series and sho
9) State and prove Cauchy condition for uniform convergence
10) Prove that every continuous function on a closed bounded subset D of R^2 is uniformly continuous on D
11) Let$\mathbb{R}^2 \rightarrow \mathbb{R}$ be defined by$f(x, y) = \begin{cases} x + y & if x \neq y \\ 1 & if\ x = y \end{cases}$,prove that $f(x, y) does\ not\ exixt\ \ at\ (0{,}0)$
12) Give an example of a function which is continuous at(x_0, y_0) but not differentiable at (x_0, y_0)
13) Find the partial derivative of the following
    i) $f(x, y) = x^2 + y^2$

ii) $f(x,y) = \begin{cases} \frac{xy}{x^2+y^2} & if(x,y) \neq (0,0) \\ 0 & if(x,y) = (0,0) \end{cases}$

14) Find the directional derivative

i)$(x,y) = \begin{cases} \frac{x^2y}{x^2+y^2} & if(x,y) \neq (0,0) \\ 0 & if(x,y) = (0,0) \end{cases}$

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