UNIVERSITY OF KERALA
SCHOOL OF DISTANCE EDUCATION

Assignment Topics for Semester-5

B.Sc MATHEMATICS 2020 Admissions

ABSRACT ALGEBRA I COURSE CODE – MM1545

QUESTIONS

1. Give examples of binary (algebraic) structures.
2. In$(Z,+)$, let $H = set\ of\ all\ multiples\ of\ 3$ and
   $K = set\ of\ all\ multiples\ of\ 5$.
   Show that H and K are subgroups of Z . Also describe $H \cap K$
3. For each binary operation $*$ defined below say whether the following is a group or not
   a) Define $* \ on\ Z$ by $a * b = a - b$
   b) Define $* \ on\ Z$ by $a * b = ab$
   c) Define $* \ on\ R^+$by $a * b = ab$
   d) Define $* \ on\ Q$ by $a * b = ab$
4. Express the following as the product of disjoint cycles
   a) $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ 3 & 2 & 5 & 7 & 1 & 6 & 4 \end{pmatrix}$
   b)$\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ 3 & 9 & 5 & 4 & 7 & 8 & 1 & 6 & 10 & 2 \end{pmatrix}$
   c)$(1\ 3\ 2\ 5)(1\ 4\ 3)(2\ 5\ 1)$
   d)$(1\ 4\ 3\ 2)(2\ 4\ 1)$

5. Compute $a^{-1}ba$where $a = (1\ 3\ 4)$ $and\ b = (2\ 3\ 5\ 4)$

6. List the elements of $Z_3 \times Z_4$ Find the order of any five elements.

7. If $\alpha = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 3 & 4 & 2 & 5 & 1 \end{pmatrix}$ $and\ \beta = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 \\ 3 & 4 & 5 & 2 & 1 \end{pmatrix}$ find $\alpha\beta\ and\ \alpha^{-1}, \alpha^2$.

REAL ANALYSIS – I COURSE CODE – 1541

QUESTIONS

1. Find all real numbers x such that
   a) $x^2 > 3x + 4$
   b) $1 < x^2 < 4$
2. Prove that $\frac{c_1+c_2+\cdots+c_n}{\sqrt{n}} \leq ({c_1}^2 + {c_2}^2 + \cdots + {c_n}^2)^{\frac{1}{2}} \leq c_1 + c_2 + \cdots + c_n$
3. Prove that $\sqrt{3}$ is not a rational number
4. Prove the sequence $\{n\}$ is divergent.
5. Prove the limit of $x_n = \frac{1}{2}[x_{n-1} + x_n]$

6. Show that $x_{n+1} = \frac{1}{2+x_n}$ is contractive and find its limits.
7. Determine whether the following limits exists and justify your answer
   a)$\lim_{x\to 0} cos\frac{1}{x}$ b) $\lim_{x\to 0} x\, sin\frac{1}{x}$ c) $\lim_{x\to 0} x\, cos\frac{1}{x}$ d)$\lim_{x\to 0} x\, sin\frac{1}{x^2}$

8. Find the following

a). $\lim_{x\to 2}\frac{x^2-4}{x-2}$

b) $\lim_{x\to 1}\frac{\sqrt{x-1}}{x-1}$

c)$lim_{x\to 0}\frac{\sqrt{1+2x}-\sqrt{1+3x}}{2+2x^2}$ $x > 0$

DIFFERENTIAL EQUATIONS MM -1543

ASSIGNMENT QUESTIONS

1. Solve the equations by the method of Integrating factors.
   (a) $\frac{dy}{dx} + 3y = e^{-2x}$
2. Solve the equation using variable separable method.
   (a) $\frac{dy}{dt} - 2y = 0$

3.Show that the equations are exact and solve

$$2xydx + x^2dy = 0$$

4.Find the integrating factor and solve the following equations:

$$(y - x^2)dx + (x^2 \sin y - x)dy = 0$$

5. Find a general solution by the method of variation of parameters.

$$y'' + 9y = \sec\ 3x$$

6 Find a general solution of the differential equations given below:

(a) $y'' + 4y = \sin\ 3x$

7.Find the general solution of the equation:

$$x^2y'' - 7xy' + +12y = 0$$

8.Solve the initial value problem:

$$x^2y'' + xy' + 9y = 0;\ y(1)\ = 2, y'(1) = 0$$

9.Find the general solution of the equation:

$$x^2y'' - 9xy' + 25y = 0$$

VECTOR ANALYSIS course code : MM - 1544

ASSIGNMENT QUESTIONS

1.If $f(x, y, z) = X^2 Y - 2 Y^2 Z^3$ find ∇f at the point (1, −1,2).

2. Compute the divergence and curl of the vector point functions. 1. $F = X^2YZi - 2X \; Z^3 j + X \; Z^2 k.$

3Evaluate $\int_C F.dr$,where $F = X^2 - Y^2 i + xyj$ and curve C is the arc of the curve $y = X^3$from (0,0) to (2,8).

4.Determine whether F is conservative vector field. If so, find a potential function for it is

$(x, y, z) = X^2Yi + 5XY^2$j

5. Evaluate using Green's Theorem $\oint 3xydx + 2xydy$, where C is the rectangle bounded by $x = -2$, $x = 4$, $y = 1$ and $y = 2$.
6. Verify Stoke's theorem when $F = x^2 i + y^2 j + z^2 k$,S is the upper hemisphere $z = \sqrt{a^2 - x^2 - y^2}$

COMPLEX ANALYSIS COURSE CODE: MM-1542

QUESTIONS

1. Find the square root of $-5 - 12i$
2. Using the Cauchy –Riemann equations verify the following is analytic or not
   i) $x^2 - y^2 + 2ixy$
   ii) $x^2 + y^2 - 2ixy$
3. Find the radius of convergence of $\sum_{n=1}^{\infty} \frac{z^n}{n!}$
4. Show that $siniy = i\ sinhy$
5. Evaluate $\int f \;\; over\ c$ where $f(z) = \; x^2 + iy^2$ where c is given by $z(t) = \; t^2 + it^2 \quad 0 \le t \le 1$