ASSIGNMENT-1

GURU JAMBHESHWARUNIVERSITY OF SCIENCE & TECHNOLOGY, HISAR

DIRECTORATE OF DISTANCE EDUCATION

Programme: M.Sc. (Mathematics) **Semester: III**

Paper Code: MAL-631 **Total Marks=15**

Nomenclature of Paper:TOPOLOGY

Important Instructions

(i) Attempt all three questions from the assignment given below. Each question carries 5 marks and the total marks are 15.

(ii) All questions are to be attempted in legible handwriting on plane white A-4 size paper and to be submitted to the Directorate of Distance Education for evaluation either in person or through Speed Post.

Q.1 Prove that in a topological space, $\bar{E} = E \cup d(E) \quad \forall E \subseteq X$.

Q.2 Characterize topology in terms of Kuratowski closure operator.

Q.3 Show that a topological space X is connectediff $\exists$ no non-empty proper subset

which is both open and closed.

ASSIGNMENT-2

GURU JAMBHESHWARUNIVERSITY OF SCIENCE & TECHNOLOGY, HISAR

DIRECTORATE OF DISTANCE EDUCATION

Programme: M.Sc. (Mathematics) **Semester: III**

Paper Code: MAL-631 **Total Marks=15**

Nomenclature of Paper:TOPOLOGY

Important Instructions

(i) Attempt all three questions from the assignment given below. Each question carries 5 marks and the total marks are 15.

(ii) All questions are to be attempted in legible handwriting on plane white A-4 size paper and to be submitted to the Directorate of Distance Education for evaluation either in person or through Speed Post.

Q.1 Show that a topological space is compact iff any family of closed sets having FIP has a non-empty intersection.

Q.2 Prove that every second countable space is separable. Show by means of anexample that the converse need not be true.

Q.3 Prove that a topological space is completely normal iff every subspace of$X$ is normal.

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DIRECTORATE OF DISTANCE EDUCATION

Programme: M.Sc. (Mathematics) **Semester: III**

Paper Code: MAL-632 **Total Marks=15**

Nomenclature of Paper:Partial Differential Equations (Assignment-I)

Important Instructions

(iii) Attempt all three questions from the assignment given below. Each question carries 5 marks and the total marks are 15.

(iv) All questions are to be attempted in legible handwriting on plane white A-4 size paper and to be submitted to the Directorate of Distance Education for evaluation either in person or through Speed Post.

1. State and prove mean value theorem for Laplace's equation.
2. State and prove Harnack's inequality for harmonic functions.
3. Find the solution of boundary value problem $\Delta u = 0$ in $B^0(0,r)$; $u = g$ on $\partial B(0,r)$ using Green's function.

Programme: M.Sc. (Mathematics) **Semester: III**

Paper Code: MAL-632 **Total Marks=15**

Nomenclature of Paper:Partial Differential Equations (Assignment-II)

Important Instructions

(i) Attempt all three questions from the assignment given below. Each question carries 5 marks and the total marks are 15.

(ii) All questions are to be attempted in legible handwriting on plane white A-4 size paper and to be submitted to the Directorate of Distance Education for evaluation either in person or through Speed Post.

1. Derive the D' Alembert formula for 1-D wave equation.
2. Find the solution of the Hamilton Jacobi equation $u_t + H(Du) = 0$ in $R^n \times (0,\infty)$ where H is the Hamilton function, by the method of separation of variables.
3. Solve the partial differential equation $-\Delta u + u = f$ in R^n where $f \in C^2(R^n)$ using Fourier transform.

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DIRECTORATE OF DISTANCE EDUCATION

Programme: M.Sc. (Mathematics) **Semester: III**

Paper Code: MAL-633 **Total Marks=15**

Nomenclature of Paper:MECHANICS OF SOLIDS-I (Assignment-I)

Important Instructions

(v) Attempt all three questions from the assignment given below. Each question carries 5 marks and the total marks are 15.

(vi) All questions are to be attempted in legible handwriting on plane white A-4 size paper and to be submitted to the Directorate of Distance Education for evaluation either in person or through Speed Post.

1. Define isotropic tensors δ_{ij} and $\in_{ijk}$. Also show that $\in_{ijm} \in_{klm} = \delta_{ik}\delta_{jl} - \delta_{il}\delta_{jk}$
2. Show that the divergence and curl of a vector field is a scalar and vector respectively.
3. Prove that principal strains are real and principal directions of strain are orthogonal to each other.

Programme: M.Sc. (Mathematics) **Semester: III**

Paper Code: MAL-633 **Total Marks=15**

Nomenclature of Paper:MECHANICS OF SOLIDS-I (Assignment-II)

Important Instructions

(i) Attempt all three questions from the assignment given below. Each question carries 5 marks and the total marks are 15.

(ii) All questions are to be attempted in legible handwriting on plane white A-4 size paper and to be submitted to the Directorate of Distance Education for evaluation either in person or through Speed Post.

1. Show that stress tensor is symmetric.
2. Discuss Mohr's diagram for finding maximum shearing stresses. Let the stress components at a point P are given by $\tau_{xx} = 2\sigma_0$, $\tau_{yy} = 4\sigma_0$, $\tau_{zz} = -\sigma_0$, $\tau_{xy} = -\sigma_0$, $\tau_{xz} = 3\sigma_0$, $\tau_{yz} = 0$ where σ_0 is a constant. Determine the stress at the point P on a plane with normal in the direction (2, 2, 1). Also determine the normal and shearing stress at P on this plane.
3. Define Poisson's ratio σ and Modulus of Rigidity μ for an isotropic elastic medium. Prove that if $\sigma = 1/2$, then $\mu = E/3$, $\lambda \to \infty$, $K \to \infty$, $\vartheta = e_{jj} = u_{i,i} = 0$ and Hooke's law is $\tau_{ij} = 2\mu e_{ij} + \frac{1}{3}\theta\delta_{ij}$. Show that in this case $u_{j,ij} = \frac{\partial \vartheta}{\partial x_i} = 0$

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DIRECTORATE OF DISTANCE EDUCATION

Programme: M.Sc. (Mathematics) **Semester: III**

Paper Code: MAL-634 **Total Marks = 15**

Nomenclature of Paper: Fluid Mechanics (Assignment-I)

Important Instructions

(vii) Attempt all three questions from the assignment given below. Each question carries 5 marks and the total marks are 15.

(viii) All questions are to be attempted in legible handwriting on plane white A-4 size paper and to be submitted to the Directorate of Distance Education for evaluation either in person or through Speed Post.

1. Define vorticity equation for the flow of incompressible fluid in the presence of conservative body force.
2. Derive equation of continuity and hence deduce the condition for incompressible fluid flow.
3. Derive equation of streamline, pathline and streakline. Find equation of streamline, pathline for the flow field defined by $\vec{q}(x^2(1+2t), yt^2, 0)$

Programme: M.Sc. (Mathematics) **Semester: III**

Paper Code: MAL-634 **Total Marks = 15**

Nomenclature of Paper: Fluid Mechanics (Assignment-II)

Important Instructions

(i) Attempt all three questions from the assignment given below. Each question carries 5 marks and the total marks are 15.

(ii) All questions are to be attempted in legible handwriting on plane white A-4 size paper and to be submitted to the Directorate of Distance Education for evaluation either in person or through Speed Post.

1. Two sources are placed at (a, 0) and (- ai, 0) and two sinks are placed at (0, ia), (0,- a). All the sources and sinks are of equal strengths, then show that the circle through these four points is a stream line.
2. State and prove Blasius theorem for force and moment on a rigid body placed in a flowing fluid and find force in a cylinder of radius 2 c.m. in the stream flow past with velocity 5 m/sec.
3. State and prove Milne- Thomson circle theorem and apply it to find the image of a source relative to a circle.

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DIRECTORATE OF DISTANCE EDUCATION

Programme: M.Sc. (Mathematics) **Semester: III**

Paper Code: MAL-635 **Total Marks=15**

Nomenclature of Paper: Advanced Discrete Mathematics (Assignment-I)

Important Instructions

(ix) Attempt all three questions from the assignment given below. Each question carries 5 marks and the total marks are 15.

(x) All questions are to be attempted in legible handwriting on plane white A-4 size paper and to be submitted to the Directorate of Distance Education for evaluation either in person or through Speed Post.

1. Explain AND, OR and NOT logical operations of propositions. Construct the truth table of $(p \to (q \wedge r)) \wedge (p' \to (q' \wedge r'))$ where p', q', r' are the negations of p, q and r.
2. Define a lattice. Give an example. Draw the Hasse diagram of D_{30}, D_{60}, D_{100}.
3. State and prove Idempotent laws, Boundedness laws and Involution law of a Boolean algebra.

Programme: M.Sc. (Mathematics) **Semester: III**

Paper Code: MAL-635 **Total Marks=15**

Nomenclature of Paper: Advanced Discrete Mathematics(Assignment-II)

Important Instructions

(i) Attempt all three questions from the assignment given below. Each question carries 5 marks and the total marks are 15.

(ii) All questions are to be attempted in legible handwriting on plane white A-4 size paper and to be submitted to the Directorate of Distance Education for evaluation either in person or through Speed Post

1. State and prove First theorem of graph theory. Also prove that there must be an even number of vertices of odd degree in a given graph. Is there a graph with 8 vertices if degree 2, 2, 3, 6, 5, 7, 8, 4?
2. Define Euler's path and circuit. Prove that if a graph has an Euler circuit, then every vertex of the graph has even degree. Is the converse true? If not, give an example.
3. Prove that a connected graph is a tree if only if there is unique and simple path between any two vertices.