Assignment

Master of Mathematics

(Through Distance Education)

M.Sc. (Mathematics)

Session: 2015-16

Directorate of Distance Education

Guru Jambheshwar University of Science & Technology

Hisar

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Assignment I

MAL 521(Advance abstract Algebra)

(For M.Sc. Mathematics, Direct students of Distance education)

Note: Attempt any three questions. **Max Marks 15**

Q 1. If $T \in A(V)$ and if dimension of V is n, and if T has n distinct characteristic roots in F, then there is a basis of V over F which consists of characteristic roots of T and m(T) is a diagonal matrix. Also give an example supporting the result (5)

Q 2. Let $T \in A(V)$ and W be an invariant subspace of V, invariant under T. Show that T induces a linear transformation T^* on $\frac{V}{W}$. Further, show that for $f(x) \in F(x)$, f(T)=0 implies that $f(T^*)=0$. Is converse also true? (5)

Q 3. Let $T \in A(V)$ be nilpotent and let $f(x) \in F(x)$ is such that $f(0) \neq 0$. Show that f(T) is regular (5)

Q 4 Prove that the matrix $\begin{bmatrix} -1 & -1 & -1 \\ 1 & 1 & 1 \\ -1 & -1 & 0 \end{bmatrix}$ is nilpotent. Find its invariants and Jordan form. (5)

Assignment II

MAL 521(Advance abstract Algebra)

(For M.Sc. Mathematics, Direct students of Distance education)

Note: Attempt any three questions. **Max Marks 15**

Q 1. Use the miniMAL polynomial of $T \in A(V)$ to write $V=V_1 \oplus V_2 \oplus \ldots \oplus V_k$. Further if T_i is the transformation induced by T on V_i. Then show that T is least common multiple of T_i, $1 \leq i \leq k$. (5)

Q 2. Define elementary divisors of $T \in A(V)$. Let V and W are two vector spaces over F and let ϕ is a vector space isomorphism of V onto W. Suppose that $T \in A(V)$ and $S \in A(W)$ are such that $(vT)\phi = (v\phi)S$. Then show that S and T have same elementary divisors. (5)

Q 3. Show that every submodule K of a completely reducible module M is direct summand of M**.** (5)

Q 4 Define free module. Give two example of the module which are free modules and two example of the module which are not free (5)

Assignment I

MAL 511(Algebra)

(For M.Sc. Mathematics, Direct students of Distance education)

Note: Attempt any three questions. **Max Marks 15**

Q 1. State and prove Zassenhaus's lemma (5)

Q 2. Show that every finite group G has a composition series. Write all the composition series of Z_{30} and Z_{210}. (5)

Q 3. Define central series, upper central series and lower central series. Find all these series for Z_{15}. Also discuss the relation between their terms. (5)

Q 4. If G is a nilpotent group and $H(\neq\{e\})$ is a norMAL subgroup of G, then $H \cap Z(G) \neq \{e\}$, Z(G) is the centre of G. Hence deduce that S_3 is not nilpotent (5)

Assignment II

MAL 511(Algebra)

(For M.Sc. Mathematics, Direct students of Distance education)

Note: Attempt any three questions. **Max Marks 15**

Q 1 Let G be a finite group. Then the following conditions are equivalent.

(i) G is nilpotent.

(ii) All maxiMAL subgroup of G are norMAL. (5)

Q 2. Prove that every prime field P is either isomorphic to Q (field of rational numbers) or Z_p, where p is prime. (5)

Q 3 If L is an algebraic extension of K and K is an algebraic extension of F, then show that L is an algebraic extension of F. Hence deduce that $Q(\sqrt{2}, \sqrt{3})$ is an algebraic extension of Q. (5)

Q 4. Show that the elements α and β are conjugate over F if and only if they have the same miniMAL polynomial. (5)

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Programme : M.Sc. Mathematics Course: Complex Analysis - 1 Code: 515

Note: Attempt all questions. Each question carry equal marks.

Assignment -1 **Max Marks:15**

Q1. For **$f(z)=z^z$** using principal logarithm find $f'(z)$, $f'(i)$, re f(z) , im f(z). (5)

Q2. if **a**$\in \boldsymbol{R}$ then show that **$U(x, y) = e^{-2axy} \cos a(x^2 - y^2)$** is harmonic in **$R^2$** . Find all its harmonic conjugates **V (x,y)** in $\boldsymbol{R^2}$. Write $\boldsymbol{f=u+iv}$ as a function of **z** with **f (0)=1** . (5)

Q3. Evaluate **I=** $\int_{\gamma} x\ dz$ **for**

(i) γ is the straight line segment from **0** to **a+ib**

(ii) γ is the circle **|z|=R**

Assignment- 2 **Max. Marks: 15**

Q1 . Using Cauchy ' theorem or Cauchy integral formula to evaluate the following integrals –

$\int_{|z|=4} \frac{z^4}{(z-i)^3}$ **dz** b. $\int_{|z|=5} \frac{z+5}{z^2-3z-4}$ **dz** (5)

Q2. Evaluate the following integrals using the Residue theorem

a. $\int_{|z-1|=3} \frac{dz}{(z^2-1)^3\,((z^2+1)}$

b. $\int_c \frac{dz}{1+z^2}$ dz where c is any circle enclosing i and -i inside . (5)

3. Find the Laurent series expansion of f(z)= $\frac{1}{z}+\frac{1}{z-2}+\frac{1}{(z+1)^2}$

(5)

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Programme : M.Sc. Mathematics

Course: Complex Analysis - 2

Code: 525

Note: Attempt all questions . Each question carry equal marks.

Assignment -1

Max.marks: 15

Q1. Write about **normal set, locally bounded set , closed set** in the space of continuation functions and find an example for each. (5)

Q2. Discuss the convergence of the infinite product $\prod_{n=1}^{\infty} \frac{1}{n^p}$ for **p>0** . (5)

Q3. Factorize **sin**πz by Weierstrass factorization theorem . (5)

Assignment -2

Max.marks: 15

Q1. Write in detail about exponent of convergence and find a formula for computation and compute exponent of convergence for some functions
(5)

Q2 . Factorize $\sin \pi z$ by Hadmard Factorization theorem.
(5)

Q3. Discuss the function $\Phi(x,y)=x^2+y^2$ for subharmonic , superharmonic and harmonic.
(5)

Assignment: I

M.Sc. Mathematics (Sem. IV) **Max. Marks: 15**

Integral Equations (MAL-644)

Q.1 Reduce the BVP

$$y''(x)+A(x)y'(x)+B(x)y(x)=g(x)$$

$y(a)=y_0,\ y(b)=y_1,\ a\le x\le b$ to the Fredholm integral equation.

Q.2 Show that the integral equation

$y(x)=f(x)+\dfrac{1}{\pi}\displaystyle\int_0^{2\pi}\sin(x+t)y(t)\,dt$ possesses no solution for $f(x)=x.$.

Q.3 Explain the method of successive approximation for the solution of Fredholm integral equation.

Integral Equations (MAL-644) **Assignment: I**

M.Sc. Mathematics (Sem. IV) **Max. Marks: 15**

Q.1 Find the resolvent kernel of the Volterra IE with kernel $K(x,t)=e^{x-t}$.

Q.2 State and prove Hilbert-Schmidt theorem.

Q.3 Determine the modified Green's function for the differential equation

$$y''(x)=0,\ y'(0)=y'(1)=0.$$

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Programme: M.Sc.(Mathematics) 3rd semester
Course **Mechanics of Solids -1**
Code MAL 633
Important instructions
All questions are to be attempted in legible handwriting on the plane white A4 size papers and handed over for evaluation to the study centers concerned (University in case of Direct student).

Total marks 30.

Part - 1 Max. Marks 15

Q. 1 Drive the equilibrium equations.
Q. 2 Explain the geometrical meaning of e_{23}.
Q. 3 Drive the equation of strain quadric of Cauchy.

Part – 2 Max. Marks 15

Q. 1 Explain the physical meaning of elastic moduli.
Q. 2 Explain the geometrical meaning of e_{13}.
Q. 3 Drive the equation of stress quadric of Cauchy.

Programme: M.Sc.(Mathematics) 1st semester
Course **Mechanics**
Code MAL 513 Important instructions
All questions are to be attempted in legible handwriting on the plane white A4 size papers and handed over for evaluation to the study centers concerned (University in case of Direct student). Total marks 30.

Part – 1 Max. Marks 15

Q. 1 State and prove Hamilton's principle.
Q. 2 State and prove Jacobi Poisson theorem.
Q. 3 Define ignorable co-ordinate and generalized momenta.

Part – 2 Max. Marks 15

Q. 1State and prove Poisson theorem.
Q. 2 Drive Lagrange's equation for a holonomic dynamical system.
Q. 3 Define Solid and Surface harmonics.

Programme: M.Sc.(Mathematics) 3rd semester
Course: **Fluid Mechanics**

Code MAL 634

Important instructionsAll questions are to be attempted in legible handwriting on the plane white A4 size papers and handed over for evaluation to the study centers concerned (University in case of Direct student). Total marks 30.

Part - 1 **Max. Marks 15**

Q. 1 Drive the equation of continuity in cartesian co-ordinates.
Q. 2 Drive Euler's equation of motion.
Q. 3 Obtain Kelvin's circulation theorem.

Part - 2 Max. Marks 15

Q. 1 Define complex potential and find the complex for two dimensional source of strength m placed at origin.
Q. 2 Drive the equation of continuity in spherical co-ordinates.
Q. 3 Define stream lines, path lines, steady motion and velocity potential.

Programme: M.Sc.(Mathematics) 4th semester

Course **Differential Geometry**

Code MAL 642

Important instructions

All questions are to be attempted in legible handwriting on the plane white A4 size papers and handed over for evaluation to the study centers concerned (University in case of Direct student). Total marks 30.

Part-1

Max. Marks 15

Q. 1 Find the angle between two parametric curves drawn on the surface.
Q. 2 Define curvature, Gauss curvature, Mean curvature, Umbilic.
Q. 3 Obtain: $H[n, n_2, r_1] = EN - FM$.

Part- 2

Max. Marks 15

Q. 1 Find the edge of regression of the envelop of the family of planes:
xsint-ycost+z-at

Q. 2 Prove that torsion of an asymptotic line is equal to the torsion its geodesic tangent.

Q. 3 In the case of a curve of constant curvature find the curvature and torsion of the locus of its centre of curvature.