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)

Guru Jambheshwar University of Science & Technology, Hisar

M. Sc. Mathematics II$^{\text{nd}}$ Semester

Assignment-I

Subject: Measure and Integration Theory (MAL-522) **MM:15**

1. Suppose f be a function defined on a measurable set E. Prove that f is measurable iff, for any open set G in R, the inverse image $f^{-1}(G)$ is a measurable set. (5)

2. Let E be a measurable set with $m(E) < \infty$, and $\{f_n\}$ a sequence of measurable functions defined on E. Let f be a measurable (real valued) function s.t. $f_n(x) \to f(x)$ for each $x \in E$. Then given $\varepsilon > 0$ and $\delta > 0$, there is measurable set $A \subset E$ with $m(A) < \delta$ and an integer N such that

   $|f_n(x) - f(x)| < \varepsilon$, for all $x \in E - A$ and all $n \geq N$. (5)

3. State and prove Egoroff's theorem on measurable functions. (5)

Assignment-II

Subject: Measure and Integration Theory (MAL-522) **MM:15**

1. A bounded function f defined on a measurable set E of finite measure is Lebesgue integrable if and only if f is measurable. (5)

2. State and Prove Vitali's Covering Theorem. (5)

3. If f be an integrable function on $[a, b]$, and suppose

$$F(x) = \int_a^x f(t)dt + F(a),$$

   then prove that $F'(x) = f(x)$ a.e. in $[a, b]$. (5)

DIRECTORATE OF DISTANCE EDUCATION
GURU JAMBHESHWAR UNIVERSITY OF SCIENCE & TECHNOLOGY, HISAR

Programme: M.Sc.(Mathematics) 3rd semester
Course Methods of Applied Mathematics
Code 523
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 Represent the vector $\vec{A} = 2y\hat{i} - z\hat{j} + 3x\hat{k}$ into spherical coordinates.
Q. 2 Define partial and multiple correlations. Also obtain mean and variance for t – distribution.
Q. 3 Define Sine and Cosine transforms. Find the Fourier Cosine transforms of $f(t) = e^{-2t} + 4e^{-3t}$.

DIRECTORATE OF DISTANCE EDUCATION
GURU JAMBHESHWAR UNIVERSITY OF SCIENCE & TECHNOLOGY, HISAR

Programme: M.Sc.(Mathematics) 3rd semester
Course Methods of Applied Mathematics
Code 523
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 - 2 Max. Marks 15

Q. 1 Represent the vector $\vec{A} = 5y\hat{i} - 2z\hat{j} + 3x\hat{k}$ into cylindrical coordinates.
Q. 2 Define normal distribution. Show that mean, mode and median of the normal distribution coincide.
Q. 3 Define Sine and Cosine transforms. Find the Fourier Sine transforms of $f(t) = e^{-4t} + 2e^{-5t}$.

Ordinary Differential Equations-II **(MAL-524)** **Assignment: I**

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

Note: Attempt all questions. Each question carries 5 marks.

Q.1 Explain the procedure to reduce the order of a LH system and hence find the solution. 5

Q.2 Prove that a necessary and sufficient condition that a solution matrix Φ of $X' = A(t)X$, be a fundamental matrix is that $\det(\Phi(t)) \neq 0$ *for* $t \in I$. 5

Q.3 Given Φ is a fundamental matrix for LH system $x' = A(t)x$. Then prove that Ψ is a fundamental matrix for its adjoint system $x' = -A^*(t)x$ iff $\Psi^*\Phi = C$, where C is a constant non-singular Matrix. 5

Ordinary Differential Equations-II **(MAL-524)** **Assignment: II**

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

Note: Attempt all questions. Each question carries 5 marks.

Q.1 State and prove the Fundamental Lemma of Calculus of Variation. 5

Q.2. Explain the concept of stability of critical points. Given that the roots of the characteristic equatio of linear autonomous system are conjugate complex with real part non-zero. Then find out th nature of the critical point (0,0) of the system. 5

Q. 3 Define Geodesic. Find extremals in isoperimetric problem

$$I[y(x), z(x)] = \int_0^1 (y'^2 + z'^2 - 4xz' - 4z)\,dx,$$

when $y(0) = z(0) = 0$, $y(1) = z(1) = 1$ and $\int_0^1 (y'^2 - xy' - z'^2)\,dx = 2$. 5

Directorate Of Distance Education

Guru Jambheshwar University Of Science & Technology

Hisar

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 $\sin\pi z$ 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)

DIRECTORATE OF DISTANCE EDUCATION

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE & TECHNOLOGY

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Programme:- Msc. Mathematics
Course: Functional Analysis
Code:- MAL-641

Important Instructions

All questions are to be attempted in legible handwriting on plane white A 4 size papers and handed over for evaluation to study centers concerned (University in case of direct student). tatal marks are 30.

PART-A **Max Marks: 15**

1. Show that the space l_p with $p \neq 2$, equipped with the norm

$$\|x\| = \left(\sum_{i=1}^{\infty} |\xi_i|^p \right)^{\frac{1}{p}}$$

where $x = (\xi_i) \in l_p$, in not an Hilbert space. (5)

2. If X is a normed linear space and Y a Banach space then prove that $B(X, Y)$ is Banach space. (5)

3. Define reflexive space and prove that $[0, 1]$ is not reflexive space. (5)

PART-B **Max Marks: 15**

1. Show that the linear space l_p with $1 < p < \infty$, equipped with the norm given by

$$\|x\| = \left(\sum_{i=1}^{\infty} |\xi_i|^p \right)^{\frac{1}{p}}$$

where $x = (\xi_i) \in l_p$, is Banach space. (5)

2. Prove that if P is projection on Banach space B and M and N are its range and null space respectively, then M and N are closed linear subspace of B such that $B = M \bigoplus N$. (5)

3. Show that dual space of l_p is l_q, where $1 < p < \infty$ and q is conjugate of p. (5)

DIRECTORATE OF DISTANCE EDUCATION
GURU JAMBHESHWAR UNIVERSITY OF SCIENCE & TECHNOLOGY, HISAR

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.

Class- M.Sc. (Mathematics)(4th Semester)

Paper code: MAL 643 Mechanics of Solids II

Part –I

Marks allotted : 15

Attempt all questions. Each question carries 5 marks.

Q 1. Define plain strain, plane stress and generalised plane stress. Obtain the fundamental equation for generalised plane stress.

Q 2. Define viscoelastic material and explain creep complianes and relaxation modulus. Also obtain the relation between them.

Q 3. Draw a stress-strain relation for a standard linear solid. Explain its creep and relaxation phase.

Part –II

Marks allotted : 15

Attempt all questions. Each question carries 5 marks.

Q 1. Explain torsion. Discuss the torsion problem of an elliptic beam.

Q 2. Define surface waves and derive the dispersion equation for Love wave in a layer of uniform thickness overlying a uniform half space.

Q3. Use Galerkin's method to find an approximate solution of the problem:

$$\nabla^2 u = -2 \; in \; R$$

u = 0 on the boundary of R

where R is rectangle $|x| \leq a; |y| \leq b$.

Sat Agar

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

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

Note: Attempt all questions. All questions carry equal marks.

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

$y(x)=f(x)+\frac{1}{\pi}\int_0^{2\pi}\sin(x+t)y(t)\,dt$ 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 I**

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

Note: Attempt all questions. All questions carry equal marks.

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

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

Class- M.Sc. (Mathematics)(4th Semester)

Programming in C

Paper code: MAL 645

Part –I

Marks allotted : ~~15~~ 9

Attempt all questions. Each question carries 5 marks.

Q 1. Write the anatomy of a C program.

Q 2. Explain different types of bugs and techniques used for debugging a C program.

Q3. Define looping. Explain briefly the statements used in C for looping.

Part –II

Marks allotted : ~~15~~ 9

Attempt all questions. Each question carries 5 marks.

Q 1. Define array. How do the processing of arrays take place? How are arrays passed as function arguments? Also give an example.

Q 2. Define scaling and the arithmetic operators used on pointers. Write a program to print the values of a variable using pointer and pointer to pointer.

Q3. Define string, its declaration and initilization. Write a program to find the length of characters in a string including and excluding spaces.