ANNAMALAI UNIVERSITY

(Accredited with 'A+' Grade by NAAC)

CENTRE FOR DISTANCE AND ONLINE EDUCATION

Annamalainagar – 608 002

Semester Pattern: 2025-26

Instructions to submit Fourth Semester Assignments

1. Following the introduction of semester pattern, it becomes **mandatory for candidates to submit assignment for each course.**
2. Assignment topics for each course will be displayed in the A.U, CDOE website (**www.audde.in**).
3. Each assignment contains 5 questions and the candidate should answer all the 5 questions. Candidates should submit assignments for each course separately. (5 Questions x 5 Marks =25 marks).
4. Answer for each assignment question should not exceed 4 pages. Use only A4 sheets and write on one side only. **Write your Enrollment number on the top right corner** of all the pages.
5. Add a template / content page and provide details regarding your Name, Enrollment number, Programme name, Code and Assignment topic. Assignments without template / content page will not be accepted.
6. Assignments should be handwritten only. Typed or printed or photocopied assignments will not be accepted.
7. **Send all Fourth semester assignments in one envelope**. Send your assignments by Registered Post to The Director, Centre for Distance and Online Education, Annamalai University, Annamalai Nagar – 608002.
8. Write in bold letters, "ASSIGNMENTS – FOURTH SEMESTER" along with PROGRAMME NAME on the top of the envelope.
9. Assignments received after the **last date with late fee** will not be evaluated.

Date to Remember

Last date to submit Fourth semester assignments	:	01.11.2025
Last date with late fee of Rs.300 (three hundred only)	:	15.11.2025

Director
CDOE

Assignment Question

018E2410 Complex Analysis- II

1. (a) Prove that $\int_0^{2\pi} \frac{d\theta}{1+a\sin\theta} = \frac{2\pi}{\sqrt{1-a^2}} (-1 < a < 1)$.

   (b) State and prove Schwarz's theorem.

   (C) State Reflection principle and Hadamard's theorem.

   (d) Represent sin π z in the form of canonical product.

2. (a) State and prove Weierstrass theorem and Laurent's theorem

   (b) Find the poles and residues at their poles of the following:

   (i) $\frac{z^2}{z^2+a^2}$, (ii) $\frac{1}{(z^2-1)^2}$

3. (a) State and prove Jensen's formula and Poisson-Jensen formula.

   (b) Prove that the infinite product $\overset{\infty}{\underset{1}{\pi}} \left(1+\frac{z}{n}\right) e^{\frac{-z}{n}}$ converges uniformly and absolutely on every compact subset.

4. (a) State and prove Arzela's theorem.

   (b) Prove that, the zeros $a_1, a_2, ..., a_n$ and poles $b_1, b_2, ..., b_n$ of an elliptic function satisfy $a_1 + a_2 + ... + a_n \equiv b_1 + b_2 + ... b_n$ (mod M).

   (c) (i) Define normal family of functions.

   (ii) Prove that $P(z) - P(u) = -\frac{\sigma(z-u)\sigma(z+u)}{\sigma(z)^2\sigma(u)^2}$.

5. (a) Prove that a family F is normal if and only if its closure $\overline{\mathrm{F}}$ with respect to the distance function $\rho(f,g) = \sum_{k=1}^{\infty} \delta_k(f,g) 2^{-k}$ is compact.

   (b) There exists a basis (ω_1, ω_2) such that the ratio $\gamma = \omega_2 / \omega_1$ satisfies the following conditions:

   (i) Im $\gamma > 0$,

   (ii) $-\frac{1}{2} < \mathrm{Re}\,\gamma < \frac{1}{2}$,

   (iii) $|\gamma| > 1$,

   and (iv) Re $\gamma > 0$, *if* $|\gamma| = 1$.

   The ratio γ is uniquely defined by these conditions.

1.

018E2420 Function Analysis

1. (i) Define normed linear space and Banach space

   (ii) State and prove Minkowski's inequality

   (iii) Prove the Theorems: Hahn – Banach and Open- Mapping

2. (a) State a d prove (i) Schwartz inequality (ii) Bessel's inequality and Triangular inequality.

   (b) If it is a complex Banach s[ace whose norm obeys

   $\|x+y\|^2 + \|x-y\|^2 = 2\|x\|^2 + 2\|y\|^2$ and

   4(x,y) = $\|x+y\|^2 - \|x-y\|^2 + i\|(x+iy)\|^2 - i\|(x-iy)\|^2$

   Prove that B is a Hilbert Space.

   (c) If p is a projection on H which range M and null space N, prove that M⊥N ⇔ p is self adjoint, and in this case $N = M^{\perp}$.

3. (a) If T is normal, then prove that the eigen spaces of T are pairwise orthogonal

   (b) If B=$\{e_i\}$ is a basis for H, prove that the matrix relative to B, is an isomorphism of the algebra β(H) onto the Matrix algebra A_n

4. (a) Show that the mapping $x \to x^{-1}$ of G into G is continuous and is Therefore a homeomorphism of G onto itself.

   (b) Prove that $\| f * g \| = \| f \| \| g \|$.

5. (a) *If* G is open in a Banach Algebra A then prove that S is closed.

   (b) If I is a proper closed two-sided ideal in A, Prove that the quotient Algebra A/I is a Banach Algebra.

018E2430 Mathematical Statistics

1. (a) State and Prove Borel-Canteli Lemma

   (b) If all the correlation coefficients of zero orders in a set of p-variates are equal to ρ, show that

   i) Every partial correlation of s-th order is $\frac{\rho}{(1+s\rho)}$ and

   ii) The coefficient of multiple correlations R of a variate with the other (p-1) variates is given by

   $$1-R^2 = (1-\rho)\left[\frac{1+(p-1)\rho}{1+(p-2)\rho}\right].$$

2. (a) State Kolmogorov Inequality and prove it.

   (b) Define random sampling and Analysis of Variance.

   (c) If T_n is a sequence of estimates such that $E(T_n) \to \theta$ and $Var(T_n) \to 0$ as $n \to \infty$, prove that T_n is consistent for θ.

3. (a) Prove that, $(n-1)\, S^2/\sigma^2$ is $\chi^2(n-1)$.

   (b) If $(X_1,Y_1), (X_2,Y_2),\ldots, (X_n,Y_n)$, $n \geq 2$ be a sample from a bivariate normal population with parameters $EX = \mu_1, EY = \mu_2$, var(X)= σ^2_1 var(Y)= σ^2_2 and cov (X,Y)=0. In other words, let $X_1, X_2,\ldots, X_n$ be iid $\mathcal{N}(\mu_1, \sigma^2_1)$ random variables and $Y_1, Y_2,\ldots, Y_n$ be iid $N(\mu_2, \sigma^2_2)$ random Variables, and suppose that X's and Y's are independent. Then prove that the pdf of R is given by $f_1(r)=$

   $$\begin{cases} \frac{\Gamma(n-1)/2}{\Gamma 1/2 \Gamma n-2/2}(1-r^2)^{n-4/2} & -1 \leq r \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

4. The life times (in hours) of samples from three different brands of batteries. We recorded with the following results.

   Brand

X	Y	Z
40	60	60
30	40	50
50	55	70
50	65	65
50	-	75
-	-	40

   Test the hypothesis that the three brands have different average Life times.

5. (a) State and Prove Neymann-Pearson Lemma

(b) Find a UMP size α test of $H_0: \theta \leq \theta_0$ against $H_1: \theta > \theta_0$ based on a sample of n observations for the following families of pdf's $f_\theta(x); \theta \ni \theta \subseteq R$,

$$f_\theta(x) = \frac{1}{\sqrt{2\pi}} e^{-(x-\theta)^2/2}; -\infty < x < \infty; -\infty < \theta < \infty;$$

018E2440 Optimization Techniques

1. (a) Use Simplex method to solve

$$\max z = 4x_1 + 10x_2$$

Subject to the constraints

$$2x_1 + x_2 \le 50$$
$$2x_1 + 5x_2 \le 100$$
$$2x_1 + 3x_2 \le 90$$
$$x_1 \ge 0 \text{and} x_2 \ge 0$$

(b) Show that, the set of all feasible solutions to the linear programming problem in convex set

2. (a) Use Big-M method to solve

$$\max z = x_1 + 2x_2 + 3x_3 - x_4$$

Subject to the constraints

$$x_1 + 2x_2 + 3x_3 = 15$$
$$2x_1 + x_2 + 5x_3 = 20$$
$$x_1 + 2x_2 + x_3 + x_4 = 10$$
$$x_i \ge 0, \quad i = 1 \text{ to } 4$$

(b) State and prove Gomory's integer cutting Algorithm.

3. (a) Use Dual Simplex method to solve

$$\min z = 3x_1 + x_2$$

Subject to the constraints

$$x_1 + x_2 \ge 1$$
$$2x_1 + 3x_2 \ge 2$$
$$x_1, x_2 \ge 0$$

(b) State and prove Duality theorem

4. (a) Use Revised Simplex method to solve

$$\max z = 3x_1 + 5x_2$$

Subject to the constraints

$$x_1 \le 4$$
$$x_2 \le 6$$
$$3x_1 + 2x_2 \le 18$$

(b) How to find the inverse of new basis from the proceeding basis by application of the elimination formulas and give the examples.

5. (a) Solve the following Transportation problem

			Supply
16	20	12	200
14	8	18	160
26	24	16	90

Demand	180	120	150

(b) (i) Define three uses of revised simplex procedure.
(ii) State that perturbation techniques.
(iii) Define Degeneracy and Anti-cycling procedures.

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