

Semester Pattern: 2024-25 – [JANUARY SESSION]

Instructions to submit First 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 First 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. **Submit assignments in prior to appear for Final Examinations of each and every semester. Once appeared, in the End Semester Examinations, assignments are not entertained.**
9. Write in bold letters, “ASSIGNMENTS – FIRST SEMESTER” along with PROGRAMME NAME on the top of the envelope.
10. Assignments received after the **last date with late fee** will not be evaluated.

Date to Remember

Last date to submit First semester assignments : **30.04.2025**

Last date with late fee of Rs.300 (three hundred only) : **15.05.2025**

Dr. T.SRINIVASAN
Director

(S018) - M.Sc MATHEMATICS
AY-2024-25– FIRST YEAR - I – SEMESTER
(JANUARY SESSION) - Assignment Questions

018E1110 - ABSTRACT ALGEBRA

1. a) Prove that any group of prime order is cyclic and can be generated by any element of the group except the identity.
b) If H and K are finite subgroups of a group G of order $O(H)$ and $O(K)$ respectively then prove that $O(HK) = \frac{O(H)O(K)}{O(H \cap K)}$.
2. a) State and Prove cauchy's theorem for abelian groups.
b) State and Prove sylow's theorem for abelian groups.
c) Let $\varphi: G \rightarrow \bar{G}$ be a homomorphism with $\ker \varphi = K$ and \bar{N} be a normal subgroup of \bar{G} , where $N = \{x \in G : \varphi(x) \in \bar{N}\}$ then prove that $\frac{G}{K} \cong \frac{\bar{G}}{\bar{N}}$.
3. a) Prove that every integral domain can be imbedded in a field.
b) Prove that the ideal $A = (p(x))$ in $F[x]$ is a minimal ideal if and only if $p(x)$ is irreducible over F .
c) Let V is finite-dimensional and W is a subspace of V then prove that W is finite dimensional, $\dim W \leq \dim V$ and $\dim V/W = \dim V - \dim W$.
4. a) Prove that $I(G) \cong G/Z$, where $I(G)$ is the group of inner automorphisms of G and Z is the centre of G .
b) Prove that an ideal M of an Euclidean ring R is a maximal ideal if and only if the ideal M is the principal ideal generated by a prime element of R .
5. a) If F is any field, prove that the ring $F[x]$ of all polynomials in x over F is a Euclidean ring.
b) If V and W are of dimensions m and n respectively over F then prove that $\text{Hom}(V, W)$ is of dimension mn over F .

018E1120 - REAL ANALYSIS

1. a) State and Prove Intermediate value theorem for Derivatives.
b) State and Prove Chain rule for Derivatives.
2. a) Let f be of bounded variation on $[a, b]$ and V be defined on $[a, b]$ as follows $V(x) = V_f(a, x)$ if $a \leq x \leq b$ and $V(a) = 0$ then Prove that
 - i. V is an increasing function on $[a, b]$.
 - ii. $(V - f)$ is an increasing function on $[a, b]$.
b) Write the Additive property of Total variation.
3. a) If $f \in R(\alpha)$ on $[a, b]$, then prove that $\alpha \in R(f)$ on $[a, b]$ and $\int_a^b f d\alpha + \int_a^b \alpha df = \alpha(b)f(b) - \alpha(a)f(a)$.
b) State and Prove Euler's summation formula.
4. a) State and Prove First Mean Value theorem for Riemann – Stieltjes Integral.
b) Write the necessary conditions for existence of Riemann- Stieltjes Integrals.
5. a) State and Prove Tauber's theorem.
b) State and Prove Abel's limit theorem.

018E1130 - DIFFERENTIAL EQUATIONS AND APPLICATIONS

1. a) Solve $y'' + 2y' + 2y = \frac{e^{-x}}{\cos^3 x}$ by using the method of variation of parameter.
b) Solve $y'' + 4y = 4 \tan 2x$ by using the method of variation of parameter.
2. a) Solve the Bessel equation $x^2 y'' + xy' + (x^2 - n^2)y = 0$ in series taking $2n$ as non- integral.
b) Solve the series the Legendre's equation $(1 - x^2)y'' - 2xy' + 4y = 0$ near the singular point $x = 1$.
3. a) Find the general solution of $(x^2 - 1)y'' + (5x + y)y' + (n + 1)ny = 0$.
b) Drive the Gauss's hyper geometric equation.
4. a) Prove that

$$\int_{-1}^1 P_m(x)P_n(x)dx = \begin{cases} 0 & \text{if } m \neq n \\ \frac{2}{2n+1} & \text{if } m = n \end{cases}$$

b) Find the first three terms of the Legendre series $f(x) = e^x$.

5. a) Prove that

$$\int_0^1 x J_p(\lambda_m x) J_p(\lambda_n x) dx = \begin{cases} 0 & \text{if } m \neq n \\ \frac{1}{2} J_{p+1}(\lambda_n)^2 & \text{if } m = n \end{cases}$$

b) Prove that

$$J_p - J'_{-p} - J'_p J_{-p} = \frac{-2 \sin p\pi}{\pi x}$$

.

018E1140 - ANALYTICAL MECHANICS

1. a) Explain the kinetic energy of a rigid body with a fixed point and angular momentum of a rigid body.
b) Explain general motion of the spherical pendulum.
2. a) Explain the equation of motion of a particle relative to the Earth surface.
b) Explain general motion of a top.
3. a) Explain the Lagrange's equation for any simple dynamical system.
b) State and prove Hamilton's principle.
4. a) Explain the Angular Momentum and General Motion of a Rigid body.
b) Discuss the motion of a simple pendulum in terms of elliptic functions and the Periodic Time of the simple pendulum
5. a) Explain the motion of a Rolling disk.
b) Describe the Lagrange's equations for motion of a particle in a plane.