A N N A M A L A I   U N I V E R S I T Y

(Accredited with 'A+' Grade by NAAC)

DIRECTORATE OF DISTANCE EDUCATION

Annamalainagar – 608 002

Semester Pattern: 2023-24

Instructions to submit Fifth 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, DDE 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 Fifth semester assignments in one envelope**. Send your assignments by Registered Post to The Director, Directorate of Distance Education, Annamalai University, Annamalai Nagar – 608002.
8. Write in bold letters, "ASSIGNMENTS – FIFTH 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 fifth semester assignments	:	**15.11.2023**
Last date with late fee of Rs.300 (three hundred only)	:	**30.11.2023**

Dr. T.SRINIVASAN

Director

B.Sc. MATHEMATICS – (S010)
V – SEMESTER
ASSIGNMENT QUESTIONS

Course Code :010E3510 - ABSTRACT ALGEBRA – I

(5x5=25 Marks)

1. Define a group. Give an example. Prove that in a group G
   (i) The identity element is unique.
   (ii) The inverse of an element is unique.
   (iii) $(a^{-1})^{-1} = a \; \forall a \in G$
   (iv) $(ab)^{-1} = b^{-1}a^{-1} \; \forall \; a, b \in G$
2. Define a subgroup. Give an example. Let H and K be two subgroups of a group G. Prove that
   (i) $H \cap K$ is a subgroup of G.
   (ii) $H \cup K$ is a subgroup of G if and only if either $H \subset K \; or \; K \subset H$.
3. Define HK, where H and K are subgroups of a group G. Prove that HK is a subgroup of G if and only if HK=KH.
4. Define a normal subgroup and Quotient group. Let φ be a homomorphism of a group G into a group $\bar{G}$. Prove that
   (i) $\varphi(e) = \bar{e}$ where e and $\bar{e}$are the identity elements of G and $\bar{G}$ respectively.
   (ii) $\varphi(x^{-1}) = [\varphi(x)]^{-1}$
   (iii) $Ker \; \varphi$ is a normal subgroup of G.
   (iv) (G) is a subgroup of $\bar{G}$.
5. Define A(S) where S is a non-empty set. State and prove Cayley's theorem.

Course Code :010E3520 - REAL ANALYSIS

(5x5=25 Marks)

1. Prove that the set $[0,1] = \{x/0 \leq x \leq 1\}$ is uncountable.
2. (a) If 0<x<1, then prove that the geometric sequence $\{x^n\}_{n=1}^{\infty}$ converges to zero.

   (b) If 1<x<∞, then prove that the sequence $\{x^n\}_{n=1}^{\infty}$ diverges to ∞.
3. State and Prove Leibnitz Test.
4. State and Prove Ratio Test.
5. State and Prove the Fundamental theorem of Calculus.

Course Code :010E3530 – MECHANICS

(5x5=25 Marks)

1. State and Prove Varigon's Theorem.
2. (a) State and Prove principle of virtual work.

   (b) Six equal uniform rods each of weight W are joined at their extremities so as to form a regular hexagon and rests hanging from the midpoint of one rod. The midpoint of this rod and opposite rod are joined by a string. Prove that the tension in the string is 3W.
3. (a) State the Newton's law of motion

   (b) Define Simple Harmonic Motion. Write down the equation of motion and solve it completely.
4. (a) Show that the law of force towards the pole for the orbit $r^n = a^n \cos n\theta$ is inversely proportional to r^{2n+3}.

   (b) Obtain the differential equations of a central orbit in polar coordinates
5. (a) Find the velocities of two smooth spheres after a direct impact between them.

   (b) State and Prove perpendicular axis theorem for moment of inertia

Course Code :010E3540 - NUMERICAL METHODS

(5x5=25 Marks)

1. Using the following table, apply Gauss's forward formula to get f (3.75)

x:	2.5	3	3.5	4	4.5	5
f(x):	24.145	22.043	20.225	18.644	17.262	16.047

2. By dividing the range into ten equal parts evaluate $\int_0^{\pi} sinx dx$ by Trapezoidal and Simpson's rule.
3. Using Newton's method find the root between 0 and 1 of $x^3 = 6x - 4$ correct to 5 decimal places.
4. Obtain the values of y at x=0.1, 0.2 using Runge-Kutta fourth order method for $y' = -y$ given $y(0) = 1$.
5. Find by Gauss elimination method, the inverse of

$$A=\begin{pmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{pmatrix}$$