Savitribai Phule Pune University

Post Graduate Diploma in Underwater Domain Awareness Framework

(Semester and Credit System)

Syllabus

(To be implemented in 2021-2022)

Department of Defence and Strategic Studies
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Total No. of Seats: 20
Eligibility: Any Graduate
Duration: One Year
Fees: Rs. 15000/-

Post Graduate Diploma in Underwater Domain Awareness Framework

The Under Water Domain Awareness Framework (UDAF) PG Diploma Course will be a two-semester course. The 32-creditcourse which spread over two semesters in one year. The diploma course carries four papers of 100 marks (4 credits) in each semester. For each paper, there will be an internal evaluation of 50 marks and the external evaluation of 50 marks. Students have to carry out research-based projects in the second semester, and will be assessed accordingly.

Aim and Objectives:

The PG Diploma course is designed to help multi-disciplinary students understand the elements of ocean science and thereby have a better understanding of military and non-military applications of Underwater Technology. The study of oceans and the seassurrounding us is of utmost importance for our national security and economy. This course is intended to fill in the vital gap in our education and introduce the students to an unfamiliar realm of oceans and underwater world. The Underwater Domain Awareness is a holistic approach to a subject that has Strategic, Geopolitical and Maritime perspectives.

The course will include Maritime Domain Awareness, Underwater Domain Awareness, Underwater Acoustics and Unique characteristics of the Indian Ocean Region, Anthropogenic Noise and Acoustic Habitat degradation, Science and Technology Issues, regulatory Framework, Submarine operations and submarine detection.

Rationale

National security is defined as the ability to preserve the nation's physical and territorialintegrity; to maintain its economic relations with the rest of the world on reasonable terms; to preserve its nature, institution, and governance from disruption from outside; and to control its borders. Somehow this is always read as the protection of our land borders, and rarely if ever the vast expanse of water that surrounds us on three sides. India has the unique privilege of being the only country to have an Ocean named after it, and yet a majority of our population rarely thinks about the Indian Ocean when National Security is discussed. As far back as 1894, Admiral AT Mahan, the famous maritime strategist had said, **"Whoever controls the Indian Ocean will control Asia. This ocean is the key to the seven seas. In the 21st Century, the destiny of the world will be decided on its waters".** Well known

strategist, KM Panikkar said this in 1940, *"While to other countries, the Indian ocean is only one of the important oceanic areas, to India it is a vital sea.*

Her lifelines are concentrated in that area, her freedom is dependent on the freedom of that water surface. No industrial development, no commerce growth, no stable political structure is possible unless her shores are protected".

Scope

The Under Water Domain Awareness Framework Course focuses on the Indian Ocean waters which is our primary area of interest. It is a region rich in natural resources and important from strategic point of view as some vital international shipping lanes pass through it.

The recent naval activities of countries hostile to India in the Indian Ocean Region, and the increasing presence of foreign submarines in our immediate maritime neighbourhood are a matter of concern. This course is intended to provide an introduction to our maritime domain with emphasis on the underwater domain.

The course will cover:

- Oceanography and hydrology aspects of the ocean, understanding of the natural resources hidden within the oceandepths, elements of seabed mining and extraction of oil and gas from the seabed, Underwater acoustics with its implications for submarine operations and the marine environment.
- Regulatory framework laid down by the UNO under the United Nations Convention on the Law of the Sea and the International Seabed Authority.
- Development of Underwater Unmanned Vehicles and the opportunities availablein the underwater domain.

Method of Teaching

While teaching the courses, there will be an attempt to introduce the Case Study Method. Sessions are arranged in an informal manner and are interactive, so that there can be debate and discussion on every aspect of the subject. Students will be asked to discuss on specific cases relating to the course and that, which has been taught in the class. Case studies would be used for the internal evaluation component of the course. Also, as a part of the course, Field Trips and visits will be organized.

Career Prospects

There are good employment opportunities in the government as well as in private organizations.Career opportunities can be explored in Environmental regulatory bodies or environmental organisation working in the field of underwater noise generation and its impact on marine habitats, Offshore oil platforms and pipelines – Inspection and Maintenance, Deep Sea Diving, Recreational Diving. Though not yet developed in India but holding great promise Underwater Tourism- Underwater museums, archaeological sites, underwater marine biodiversity parks can also be explored as career options. Those students who wants to pursue higher education can apply to National Institute of Oceanography, Goa, and National Institute of Ocean Technology, Chennai.Depending on other qualifications one can serve as research scientist, engineer, environmental expert etc. in any of the areas mentioned.

SemesterI

Course No	Course Title	Course Credit	Total Marks
UDAF 1.1	National Security: Key Concepts	4	100
UDAF1.2	Maritime Domain Awareness	4	100
UDAF1.3	Underwater Acoustics, Anthropogenic Noise and Acoustic Habitat Degradation	4	100
UDAF1.4	Marine Resources, Deepsea Mining, Blue Economy and SAGAR	4	100

SemesterII

Course No	Course Title	Course Credit	Total Marks
UDAF 2.1	Underwater Cables and Pipelines	4	100
UDAF 2.2	Introduction to ROV & AUV	4	100
UDAF 2.3	Recreational Opportunities	4	100
UDAF 2.4	Dissertation	4	100

Summary

Semester	Credits	Marks
Semester I	16	400
Semester II	16	400
Total	**32**	**800**

Semester I

UDAF 1.1 National Security: Key Concepts

This is one of the core courses that provide the students an understanding of various dimensions of National Security. In the recent years the National Security issues have caught the attention of scholars all over the world. This has been because of insecurity and instability. As a result, the problems of National Security have acquired a new dimension.

1. Concepts:
   Nation;
   Nationalism
   Nation State
   National Power
   National Security
2. Key Concepts of Security:
   Balance of Power,
   Deterrence, Brinkmanship and Compellence
   Collective Security
   Neutrality,
   Nonalignment,
   Equal Security,
   Common Security,
   Comprehensive Security,
   Human Security.
3. Approaches to Peace:
   Diplomacy,
   International Law,
   United Nations and Pacific Settlement of Disputes
   Arms Control and Disarmament.
   Track II diplomacy

Readings

- Mishra K.P. (ed) Foreign Policy of India: A Book of Readings (New Delhi: Thompson (1977)
- Prasad Bimal (ed) India's Foreign Policy: Studies in Continuity and Change (New Delhl: Vikas,1979)
- Sen Garitam, Haksar P.N. India's Foreign Policy and its Problems ((Delhi: Atlantic, 1993)
- Paranjpe Shrikant Parliament and the Making of Indian Foreign Policy: A Study of Nuclear Policy (New Delhi Radiant,1997)
- Thakkar Usha and Kulkarni Mahesh India in World Affairs: Towards the 21st Century
- (Mumbai: Himalaya,1999)
- T.D Joseph, Winning India's Next War, (New Delhi: Knowledge Publishers,2008)
- Vijay Khare, Dr. B.R Ambedkar and India's national Security) New Delhi. Kilaso,2005)

Journals:

- International Studies (New Delhi),
- India Quarterly (New Delhi)

Report:

- Annual Report of Ministry of External Affairs,
- Government of India, New Delhi (Latest available)

UDAF 1.2 Maritime Domain Awareness

1. Underwater Domain Awareness.
   Brief introduction to ocean environment
   Ocean floor characteristics,
   Waves, Tides,
   Currents, seawater properties;
   General Oceanography
2. Estuarine dynamics
   Coastal Engineering
   Commercial Applications
   Defence Applications

Readings:

- Shridhar Prabhurman& Arnab Das, Automatic Identification System (AIS) Data Analysis, Online available at http://indianmaritimefoundation.org/mrc/documents/researchNotes/Shridhar/AIS_Data_Analysis.pdf
- Ashok Kapur, Geopolitics and the Indo-Pacific Region, Routledge,(2019)
- Mohan Malik (ed.)Maritime Security in the Indo-Pacific: Perspectives from China, India and the United States (Rowman and Littlefield, 2014).
- Arnab Das. Impact of maritime security policies on the marine ecosystem.

UDAF 1.3 Underwater Acoustics

1. Underwater Acoustics
2. Anthropogenic Noise
3. Acoustic Habitat

Readings:

- Arnab Das. Shallow ambient noise variability due to distant shipping noise and tide. Applied Acoustics, 72(9):660–664, 2011.
- Che, S., Meng, C., Bai, J., & Wu, W. (2016). Mapping underwater sound noise and assessing its characteristic based on AIS. 2016 IEEE/OES China Ocean Acoustics (COA). doi:10.1109/coa.2016.7535796
- Coward S (2013) A method for remote sensing of acoustic ship noise. Masters, Institutt for elektronikkogtelekommunikasjon, online available at http://brage.bibsys.no/xmlui/handle/11250/2370989.
- Erbe, C., MacGillivray, A., & Williams, R. (2012). Mapping cumulative noise from shipping to inform marine spatial planning. The Journal of the Acoustical Society of America, 132(5), EL423-EL428.
- Leaper R, Renilson M, Ryan C (2014) Reducing underwater noise from large commercial ships: current status and future directions. J Ocean Technol 9(1):50–69.
- Roul, S., Kumar, C. R. S., & Das, A. (2019). Ambient noise estimation in territorial waters using AIS data. Applied Acoustics, 148, 375-380.
- shipping noise in the Eastern Mediterranean Sea. In INTER-NOISE and NOISE-CON Congress and Conference Proceedings (Vol. 253, No. 7, pp. 1776-1783). Institute of Noise Control Engineering.
- Shridhar Prabhuraman& Arnab Das Shipping Radiated Noise Estimation Techniques, online available at http://indianmaritimefoundation.org/mrc/documents/researchNotes/Shridhar/Shipping_Radiated_Noise_Estimation_Techniques.pdf
- Vern O Knudsen, RS Alford, and JW Emling. Underwater ambient noise. J. Mar. Res., 7:410–429, 1948.
- Wales, S. C., &Heitmeyer, R. M. (2002). An ensemble source spectra model for merchant ship-radiated noise. The Journal of the Acoustical Society of America, 111(3),1211-1231.

UDAF 1.4.Marine Resources

1. Marine Resources
2. Coastal Waters
3. Sea Lines of Communication (SLOC),
4. Deepsea Mining
5. Preventing proliferation of submarines and mine capabilities
6. Commercial activities in the undersea realm
7. Blue Economy
8. Security and Growth for All in the Region (SAGAR)
9. Blue economic entities

Readings:

- CarolinLiss 2010. Oceans of Crime: Maritime Piracy and Transnational Security in Southeast Asia and Bangladesh. Institute of Southeast Asian Studies, Singapore.
- Kapil Narula 2019. The Maritime Dimension of Sustainable Energy Security. Springer, Singapore.
- Edited by Joshua Ho, Sam Bateman 2012. Maritime Challenges and Priorities in Asia: Implications for Regional Security. Routledge, Australia.
- Benny, Daniel J 2016. Maritime Security: protection of marinas, ports, small watercraft, yachts, and ships. CRC Press, USA.

Semester II

UDAF 2.1 Underwater Cables and Pipelines.

1. Purpose & design.
2. Fundamentals of mooring system and mooring cables.
3. Submarine Pipelines: Interaction of Pipelines with Seabed: Free Span,
4. Scouring and Burial of Seabed Pipelines,
5. Forces On Sea-Bed Pipelines,
6. Current & Wave-Induced Vibrations of Pipelines,
7. Lifting-Off of Pipelines

Readings:

- Huacan Fang, MenglanDuan,Chapter 6 - Submarine Pipelines and Pipeline Cable Engineering,Editor(s): Huacan Fang, MenglanDuan,Offshore Operation Facilities,Gulf Professional Publishing,2014,Pages e1-e181.
- Yong Bai, Qiang Bai, in Subsea Pipelines and Risers, 2005
- R. Lambourne, in Paint and Surface Coatings (Second Edition), 1999

UDAF 2.2 Introduction to ROV& AUV.

1. Autonomous Underwater Vehicle
2. How does it work?
3. Origin and Evolution
4. Who built it and when?
5. Piloted/Unpiloted
6. Introduction to science principles necessary to construct a Remotely Operated Vehicles

Readings:

- Gibbons, Gail. Exploring the Deep, Dark Sea. Little, Brown Young Readers, April 1, 2002. ISBN 10: 0316755494.
- Platt, Richard. Eyewitness: Shipwrecks. DK Children, June 1, 2000. ISBN 10: 0789458845.
- Rose, Paul; Anne Laking, and Phillippe Cousteau.Oceans: Exploring the Hidden Depths of the Underwater World. University of California Press, April 15, 2009. ISBN 10: 0520260287
- Walker, Sally M. Shipwreck Search: Discovery of the H. L. Hunley (On my Own Science). First AvenueEditions, November 30, 2006. ISBN 10: 0822564491.

UDAF 2.3 Recreational Opportunities.

1. Underwater observatories.
2. Recreational diving.
3. Swimming and Diving.
4. Surfing.
5. Waterskiing.
6. Canoeing and Kayaking.
7. Rowing.
8. Deep Water Fishing.
9. Sailing.
10. Scuba diving

Readings:

- Graver, Denis K. Scuba Diving. Champaign, IL: Human Kinetics, 2003.
- McManners, Hugh. Water Sports: An Outdoor Adventure Handbook. New York: DK Publishers, 1997.
- Slater, Kelly. Pipe Dreams: A Surfer's Journey. New York: Regan Books, 2003.
- Websites
- Channel Swimming Association.http://www.channelswimmingassociation.com (accessed on August 27, 2004).
- International Sailing Federation.http://www.sailing.org (accessed on August 27, 2004).
- Volvo Ocean Race Round the World.http://www.volvooceanrace.org (accessed on August 27, 2004).

UDAF 2.4 Dissertation

Students are advised to select their topic in consultation with their guide. Dissertation will evaluate by expert in concern field and marks will be given by the quality of research work. Dissertation may publish in Book form without permission of students. It will be the copy right and property of Department of Defence and Strategic Studies and University of Pune.

Format of Submission:

(a) Students are required to submit TWO Copies of the dissertation, duly typed and bound.

(b) Use A 4 size paper and use Times New Roman script with 12 font size and one and a half spacing for lines.

Evaluation

1. The evaluation shall be done by the Internal Examiner (Guide) and one External Examiner from within the Department. (Evaluation done in a combined manner for 50 marks)

2. Students would have to make a presentation in the Department. (Evaluation done by the Guide and the External Examiner who evaluates the written report in a combined manner for 20 marks)

3. Evaluation: Dissertation: 80 marks. 20 Marks: Viva – Total: 100 marks.