DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIES
FACULTY OF GEO-SCIENCES

Curriculum for Masters of Science (MS)
Session 2022-2023

University of Rajshahi, Bangladesh
www.ru.ac.bd

PART A

1. Title of the Academic Program:

Masters of Science in Geography and Environmental Studies

2. Name of the University:

University of Rajshahi, Rajshahi 6205, Bangladesh

3. Vision of the University:

To pursue enlightenment and creativity for producing world-class human resources to cater for the needs of changing time.

4. Mission of the University:

- MU1: to ensure a world-class curriculum with talented academicians and conducive academic and research environment for generation and dissemination of knowledge.
- MU2: to maintain international standards in education with focus on both knowledge and skills, and humanitarian and ethical values to meet the needs of the society and state.
- MU3: to develop strategic partnerships with leading national and international universities, and organizations for academic as well as research collaborations.

5. Name of the Program Offering Entity:

Department of Geography and Environmental Studies, Faculty of Geo-Sciences

6. Vision of the Entity:

To be a centre of academic excellence in Geography and Environment through quality teaching-learning, professional development, innovative and cutting-edge research, use of modern geo-spatial techniques, and community engagement.

7. Mission of the Entity:

- ME1: to **provide** quality education and training in the fields of geography and environment with interactive teaching and learning strategies.
- ME2: to **equip** students with intellectual and technical skills in order to meet the challenges associated with the continuing evolution of geographic & environmental sciences and to develop the carrier based on requirements of the society.
- ME3: to **conduct** disciplinary and integrated research for contributing new innovations that spans local to global scales, with an emphasis on a geospatial perspective of our changing planet and its sustainability.
- ME4: to **apply** geographic science to societal and environmental issues for the development of the nation and the global community.
- ME5: to **create/establish** platform for local, national, global community for sharing and disseminating knowledge and skills through quality publication, conference, seminar/symposium, and building international collaboration and partnership.

8. Objectives of the Entity (OE):

- OE1: to provide professional post-graduates in the field of geography and environmental studies considering requirements of contemporary job markets.
- OE2: to publish in leading professional journals to contribute the theoretical development and application regarding geography and environmental studies addressing the various issues.
- OE3: to disseminate recent knowledge about geography and environmental studies to ensure effective applications of statistics in real life practices.
- OE4: to deliver adequate, relevant and timely assessment about geospatial phenomena to facilitate research, planning and decision-making process for the government and the community for achieving Sustainable Development Goals (SDGs) of Bangladesh.

9. Name of the Degree:

Masters of Science (M.S.) in Geography and Environmental Studies

10. Description of the Program:

The Masters of Science (M.S.) in Geography and Environmental Studies program has been meticulously crafted to provide students with an all-encompassing understanding of the dynamic interplay between the Earth's environment and human society. This interdisciplinary program seamlessly integrates the study of physical geography, human geography, environmental science, and geospatial technology, endowing students with the knowledge and skills imperative for addressing the critical global environmental challenges of our era.

This comprehensive curriculum unfolds over one and half years, spanning two semesters for general students and three semesters for research students. Each 2-credit course holds a weightage of 50 marks, while 3-credit courses are attributed 75 marks. Each course, whether 2-credit or 3-credit, contributes significantly to the students' overall learning experience. No research components are included for general group students. Furthermore, in the Third semester, research students could undertake a dissertation worth 8 credits within their chosen topic under the supervision of a potential supervisor which serves as a motivational stepping stone for prospective students aiming for higher studies such as M.Phil. or Ph.D.

Throughout the program, continuous assessments manifest in the form of theoretical examinations, practical assessments, class assessments, and viva-voce examinations at the end of each semester. The coveted degree of M.S. in Geography and Environmental Studies is conferred based on the Cumulative Grade Point Average (CGPA) attained by a candidate across M.S. examinations.

The detailed rules and regulations, along with the required GPA, credit points, and class attendance for promotion, improvement, and degree awards, are provided in the following sections.

The Grading Systems:

    (a) Credit Point (CP): The credit points achieved by an examine for 0.50 and 1.00 unit courses shall be 2 and 4, respectively. For other fraction of a unit, proportionality should be applied.

    (b) Letter Grade (LG) and Grade Point (GP): Letter Grades, corresponding Grade Points and Credit Points shall be awarded in accordance with provisions shown below:

i) Table of LG, GP and CP for Credit Courses:

Numerical Grade	LG	GP/Unit
80% and above	A+ (A Plus)	4.00
75% to less than 80%	A (A regular)	3.75
70% to less than 75%	A- (A minus)	3.50
65% to less than 70%	B+ (B Plus)	3.25
60% to less than 65%	B (B regular)	3.00
55% to less than 60%	B- (B minus)	2.75
50% to less than 55%	C+ (C Plus)	2.50
45% to less than 50%	C (C regular)	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00
Incomplete	I	0.00

Absence from the final examination shall be considered incomplete with the letter grade "I"

Calculation of GPA and CGPA:

The calculation of GPA and CGPA will be carried out using the following process. Suppose a student has completed four courses in each of the first and second semesters. The student will then obtain the following grades:

An Example for Non-Thesis Group:

1st Semester Course	Credits	Grade	GP	$(GPA)_1$
GEST 5101	3	A	3.75	$\dfrac{3(3.75) + 3(4.00) + 3(3.25) + 3(2.75)}{3 + 3 + 3 + 3}$
GEST 5102	3	A+	4.00	
GEST 5103	3	B+	3.25	$= \dfrac{41.25}{12} = 3.4375 = 3.437$
GEST 5104	3	B-	2.75	

2nd Second Semester	Credits	Grade	GP	$(GPA)_2$
GEST 5201	3	A+	4.00	$\dfrac{3(4.00) + 3(3.00) + 3(3.75) + 3(3.25)}{3 + 3 + 3 + 3}$
GEST 5202	3	B	3.00	
GEST 5203	3	A	3.75	$= \dfrac{42}{12} = 3.5 = 3.5$
GEST 5204	3	B+	3.25	

His/her CGPA is: $\dfrac{3.437+3.5}{2} = 3.4685 = 3.468$

LG corresponding to CGPA = 3.468 is "B+"

Award of Degree, Promotions and Improvement of Results:

1.1 There shall be final examinations at the end of each semester conducted by the Examination committee of the Department.

1.2 1st and 2nd Semester results must be published by the Controller of Examinations. The results shall be finalized at the end of the 2nd semester of the programme for general/non-thesis group and shall be finalized at the end of the 3rd semester for thesis group students..

1.3 **Minimum passing Grade:** The minimum passing Grade in a theoretical course will be D and the minimum passing Grade in a Practical/Laboratory/Project/Fieldwork/Internship/ In-Plant Training, Thesis and Viva-Voce course will be Grade D.

1.4. Promotion to Higher Semester: A student who has:
   i) A minimum Grade Point Average (GPA) of 2.25 or higher obtained in 1st/2nd Semester,
   ii) A minimum TCP of 8 obtained in 1st/2nd Semester and
   iii) At least Grade D in the Practical/Laboratory and Viva-Voce courses of the 1st and 2nd semester shall be promoted to the 2nd and 3rd Semester respectively.

1.5. There shall be no improvement in Practical/Laboratory/Filedwork/In-Plant Training/Project/ Thesis and Viva-Voce course. A student failing to secure a minimum Grade D in any of these courses in any semester shall fail the semester.

1.6. **Grade Point Improvement:**

1.6.1	A promoted student who obtains less than Grade B in theoretical course in any semester, may appear in the upcoming regular examination of that semester to improve the Grade points.
1.6.2	Grade obtained by a student in the courses in which he/she appeared for improvement will be recorded for final assessment according to clause 12.6.1 and the Grade obtain by him/her in those courses at the regular final examination shall automatically cancelled.
1.6.3	Clause 12.6.2 is not valid for a candidate who cannot improve his/her course Grade; in that case the previous Grade shall remain valid.

1.7. Course Exemption: Students who fail to be promoted to the 2nd and 3rd semester shall be exempted from taking the theoretical and laboratory courses where they obtained Grades equal to or better than B. These Grades would be counted towards calculating SGPA in the retained semesters.

1.8. Merit Position: The SGPA obtained by a regular student in a semester final examination will be considered for determining the merit position for the award of scholarships, stipends etc.

1.9. Credit Transfer: A student will be allowed at best one semester in his/her graduate programme with the relevancy of course curriculum from a designated university under exchange program. Credit of a semester completed from the foreign university will be added which will not be more than the assigned credit for the semester and maximum 8 Credits can be adjusted in the immediate next semester. Subject and courses should be approved through the equivalence committee of the faculty.

Distribution of Marks for Class Attendance:

1. In order to be eligible for appearing at the semester final examinations as a regular candidate, a student shall be required to have attended at least 70% of the total number of Lectures/Tutorials/ Practical/Laboratory classes held in the semester. The Practical/ Laboratory Courses mean all Practical/Laboratory/Project/Fieldwork/Internship/In-plant Training or similar courses.

2. A student whose attendance is 60% to less than 70% may be allowed to appear at the final examinations as an irregular student but he/she shall not be eligible for any scholarship or

stipend.

3. Student having less than 60% attendance will not be allowed to appear at the final examinations of the semester.

4. The concerned course teacher shall prepare an attendance report of the students. The report will submitted to the Chairman of the Department within three days of the last class of the course. Award marks for class attendance of the students shall also be prepared by the concerned course teacher an submitted to the Chairman of the Examination Committee and Controller of Examination of Rajshahi University in a sealed cover.

5. The percentage of attendance of the re-admitted students shall be counted from the date of the start of the semester or from his/her previous attendance of the semester.

Attendance	Marks
90% and above	100%
85% to less than 90%	90%
80% to less than 85%	80%
75% to less than 80%	70%
70% to less than 75%	60%
65% to less than 70%	50%
60% to less than 65%	40%
Less than 60%	0

Course and Credit Distribution for the General/Non-Thesis MS Program

Semester	Nature of courses	Credits
1st semester	Theoretical	12
	Practical/Laboratory	4
2nd Semester	Theoretical	12
	Practical/Laboratory	4
	Fieldwork	2
	Viva-voce	2
Total		36 credits

Course and Credits Distribution for the Thesis Group MS Program

Semester	Nature of courses	Credits
1st semester	Theoretical	12
	Practical/Laboratory	1
2nd Semester	Theoretical	12
	Practical/Laboratory	1
	Viva-voce	2
3rd Semester	Dissertation/Thesis	6
	Defense /presentation	2
Total		36 credits

Curriculum for General
Non Thesis MS Program, Semester: 1
Examination: 2023

Course No.	Major Courses	Units	CA[1]	CE[2]	Atd[3]	Total	Credit
			Marks				
GEST 5101	Flood and River Management	0.75	15.0	52.0	8	75	3.0
GEST 5102	Environmental Impact Assessment	0.75	15.0	52.0	8	75	3.0
GEST 5103	Disaster Management and Planning	0.75	15.0	52.0	8	75	3.0
GEST 5104	Natural Disaster Forecast and Simulation	0.75	15.0	52.0	8	75	3.0
Total Theoretical Courses = 4		3.00	300				12.0

Course No.	Practical Courses	Units	LA[4]	LE[5]	Total	Credit
			Marks			
GESP 5101	Application of Quantitative Techniques in Geography	0.50	14.0	36.0	50	2.0
GESP 5102	Map Study and Network Analysis	0.50	14.0	36.0	50	2.0
Total Practical Courses = 2		1.00	100			4.0

Grand Total (Theory and practical) for Semester 1	4. 00	400	16.0

CA[1] = Class Assessment; CE[2]= Course Evaluation, Atd.[3] = Attendance
LA[4] = (Lab Attendance & Assessment) with 14 marks: The course teacher will decide the marks distribution,
LE[5] = (Lab Evaluation)

Curriculum for General

Non Thesis MS Program, Semester: 2
Examination: 2023

Course No.	Major Courses	Units	Marks				Credit
			CA[1]	CE[2]	Atd[3].	Total	
GEST 5205	Geography of Migration and Refugee Management	0.75	15.0	52.0	8	75	3.0
GEST 5206	Regional Planning Techniques	0.75	15.0	52.0	8	75	3.0
GEST 5207	Urban Planning	0.75	15.0	52.0	8	75	3.0
GEST 5211	Remote Sensing for Coastal and Marine Environment Management	0.75	15.0	52.0	8	75	3.0
Total Theoretical Courses = 4		3.00	300				12.0

Course No.	Practical Courses	Units	Marks			Credit
			LA[4]	LE[5]	Total	
GESP 5203	Application of Advance GIS and Remote Sensing Techniques	0.50	14.0	36.0	50	2.0
GESP 5204	Micro-region Survey, and Preparing Weather and Climate Maps	0.50	14.0	36.0	50	2.0
GESF 5201	Field Work	0.50		50		2.0
GESV 5201	Viva-voce	0.50		50		2.0
Total including practical, field work report and viva-voce		2.00	200			8.0

Grand Total (Theory, practical and viva-voce) for Semester 2		5. 00	500			20.0

CA[1] = Class Assessment; CE[2]= Course Evaluation, Atd.[3] = Attendance
LA[4] = (Lab Attendance & Assessment) with 14 marks: The course teacher will decide the marks distribution,
LE[5] = (Lab Evaluation)

Curriculum for Thesis Group
MS Program, Semester: 1
Examination: 2023

Course No.	Major Courses	Units	Marks				Credit
			CA[1]	CE[2]	Atd[3]	Total	
GEST 5101	Flood and River Management	0.75	15.0	52.0	8	75	3.0
GEST 5102	Environmental Impact Assessment	0.75	15.0	52.0	8	75	3.0
GEST 5103	Disaster Management and Planning	0.75	15.0	52.0	8	75	3.0
GEST 5104	Natural Disaster Forecast and Simulation	0.75	15.0	52.0	8	75	3.0
Total Theoretical Courses = 4		3.00	300				12.0

Course No.	Practical Courses	Units	Marks			Credit
			LA[4]	LE[5]	Total	
GESP 5101	Application of Quantitative Techniques in Geography	0.125	3.5	9	12.5	0.5
GESP 5102	Map Study and Network Analysis	0.125	3.5	9	12.5	0.5
Total Practical Courses = 2		0.25	25			1.0

Grand Total (Theory and practical) **for** Thesis Group MS Program, Semester 1		3.25	325			13.0

CA[1] = Class Assessment; CE[2]= Course Evaluation, Atd.[3] = Attendance
LA[4] = (Lab Attendance & Assessment) with 14 marks: The course teacher will decide the marks distribution,
LE[5] = (Lab Evaluation)

Curriculum for Thesis Group
MS Program, Semester: 2
Examination: 2023

Course No.	Major Courses	Units	CA[1]	CE[2]	Atd[3].	Total	Credit
GEST 5205	Geography of Migration and Refugee Management	0.75	15.0	52.0	8	75	3.0
GEST 5206	Regional Planning Techniques	0.75	15.0	52.0	8	75	3.0
GEST 5207	Urban Planning	0.75	15.0	52.0	8	75	3.0
GEST 5211	Remote Sensing for Coastal and Marine Environment Management	0.75	15.0	36.0	8	75	3.0
Total Courses = 4		3.00	300				12.0

Course No.	Practical Courses	Units	LA[4]	LE[5]	Total	Credit
GESP 5203	Application of Advance GIS and Remote Sensing Techniques	0.125	3.5	9	12.5	0.5
GESP 5204	Micro-region Survey, and Preparing Weather and Climate Maps	0.125	3.5	9	12.5	0.5
GESV 5201	Viva-voce	0.50		50		2.0
Total including practical, and viva-voce		0.75		75		3.0

Grand Total (Theory, practical, and viva-voce) for Thesis Group MS Program, Semester 2		3.75	375			15.0

CA[1] = Class Assessment; CE[2] = Course Evaluation, Atd.[3] = Attendance
LA[4] = (Lab Attendance & Assessment) with 14 marks: The course teacher will decide the marks distribution,
LE[5] = (Lab Evaluation)

Curriculum for Thesis Group
MS Program, Semester: 3
Examination: 2023

Course No.	Major Courses	Units	Marks				Credit
			CA[1]	CE[2]	Atd[3].	Total	
GESD/T 5301	Dissertation/Thesis	1.50	-	-	-	150	6.0
GESDP 5301	Thesis Defense/Presentation	0.50				50	2.0
Grand Total for Thesis Group MS Program, Semester 3		2. 00	200				8.0

CA[1]= Class Assessment; CE[2] = Course Evaluation, Atd.[3] = Attendance

Detailed Course Curriculum
for the General/Non-Thesis and Thesis Group
MS Programs, 1st Semester

GEST 5101	Flood and River Management
GEST 5102	Environmental Impact Assessment
GEST 5103	Disaster Management and Planning
GEST 5104	Natural Disaster Forecast and Simulation
GESP 5101	Application of Quantitative Techniques in Geography
GESP 5102	Map Study and Network Analysis[*]

COURSES	TOTAL CREDITS	TOTAL MARKS
THEORY COURSES	12.0	300
PRACTICAL COURSES[*]	4.0/1[*]	100/25[*]
TOTAL	16.0/13 (THESIS)	400/325 (THESIS)

[*]The number of theoretical courses and credits is identical for both the General/Non-Thesis and Thesis Group MS Programs. However, while the number of practical courses is also the same for both programs, the total assigned credits differ: 4 credits for the General/Non-Thesis MS Program and only 1 credit for the Thesis Group MS Program.

Course Title: Flood and River Management
Course Code: GEST-5101, Credit: 3, Full Marks: 75
Number of Classes: Approximately 24 (45 minutes class duration)

Course description:
The course is designed to introduce core aspects of riverine environment and its impact on the socio-economic conditions. Primarily, focus will be given on the problems of floods and its consequences. Moreover, it will help to formulate a well-defined flood and river management policy.

Course Learning Outcomes (CLOs):
CLO1: Able to understand the types and nature of floods, the relationship among topography, river and flood.
CLO2: Able to explain flood estimation procedures and examine controlling measures.
CLO3: Able to assess various issues of flood and river management policies.

CLOs	Course Contents	TLS	AS
CLO1	Flood and river management: issue, significance, and components.	Lecture, Discussion, Presentation, Assignment	Tutorial (quiz/ presentation/ assignments/exam), Terminal, Final examination
CLO1	Floods: concepts, causes, types and consequences. Physical and topographical features of Bangladesh and flooding. Human perception and adjustment to flooding		
CLO1 & CLO2	Watershed: concept, delineation, and management. Floods: Estimation and control measures. Inundation mapping		
CLO1 & CLO3	Floods and river systems in Bangladesh and its management.		
CLO2	Impact of flood control and damage on environment. Urban flooding and drainage.		
CLO3	River management policies and problems in Bangladesh. Bangladesh Delta Plan 2020.		

TLS: Teaching-learning Strategy   AS: Assessment Strategy

References:
Wazed, Abdul. (1991). *Bangladesher Nadimala (Rivers of Bangladesh, in Bangla)*. Dhaka.

Khan, F.H. (1991). *Geology of Bangladesh.* University Press Limited, Dhaka.

Brammer, H. (1990). *Floods in Bangladesh: Geographical Background to the 1987 and 1988 Floods.* The Geographical Journal. 156 (1): 12–22. doi:10.2307/635431. JSTOR 635431.

Rashid, Haroun er. (1991). *Geography of Bangladesh*. University Press Limited, Dhaka.

Alam, M.S. (2012). *Sea Level.* in Sirajul Islam; Ahmed A. Jamal (eds.), Banglapedia: National Encyclopedia of Bangladesh (Second ed.), Asiatic Society of Bangladesh.

Priyangika, Nishanthi. (1999). *Hundreds of thousands hit by Bangladesh floods*. wsws.org.

Uddin, K., Matin, M.A., Meyer, F.J. (2019). *Operational Flood Mapping Using Multi-Temporal Sentinel-1 SAR Images: A Case Study from Bangladesh*. Remote Sensing. 11 (13):1581. Bibcode:2019RemS 11.1581U. doi:10.3390/rs11131581.

Course Title: Environmental Impact Assessment
Course Code: GEST-5102, **Credit:** 3, **Full Marks:** 75
Number of Classes: Approximately 24 (45 minutes class duration)

Course Description:
In general, this course will discuss about the concept, necessary tools and methods for environmental impact assessment. Besides, it also describes identification, prediction and evaluation of the EIA process as well as evaluation of environmental, socioeconomic, cultural and other impacts of a proposed development project. Preparation of report, formulation of legal policy for EIA, recognition of the potential risks of the development project, and mitigation actions for reducing the negative impacts and increasing the positive contributions to the natural environment will also be addressed.

Course Learning Outcomes (CLOs):
CLO1: Able to define the concept of EIA, its nature, purposes and history.
CLO2: Able to understand the process of EIA.
CLO3: Able to explain and apply an overview of the tools and methods used to identify, predict and evaluate different types of impacts of EIA.
CLO4: Able to analyze the role, scope and contribution of public involvement in the EIA and decision-making processes.
CLO5: Able to report on preparing and submitting an EIA report.
CLO6: Able to formulate the legal policy of environment and institutional arrangements and directions of EIA.

CLOs	Course contents	TLS	AS
CLO1	Origins of EIA; development, purpose and aims of EIA.	Lecture, Discussion, Presentation, Assignment	Tutorial (quiz/ presentation/ assignments/exam), Terminal, Final examination
CLO2	The EIA process, key elements and stages in this process.		
CLO3	Methods of Impact Assessment: checklists, matrices,networks and overlays.		
CLO4	The EIA planning process, the decision-making process and public participation; understanding of the strengths and limitations of EIA.		
CLO3	Mitigation and impact management; link between EIAprocess and mitigation.		
CLO6	Environmental Management Plan.		
CLO5	Preparation, presentation and review of EIA Report.		
CLO6	Strategic Environmental Assessment, contribution of EIA and SEA to sustainable development: Environmental Sustainability Index		
CLO6	National environmental policy and environmental management plan of Bangladesh.		

TLS: Teaching-learning Strategy   AS: Assessment Strategy

References
IISD (2016). *Environmental Impact Assessment Training Manual*. Manitoba, Canada.
Modak, P. and Biswas, A.K. (1999). *Conducting Environmental Impact Assessment in Developing Countries*. UnitedNations University Press, Tokyo, New York, Paris.
UNEP (2002). *Environmental Impact Assessment Training Resource Manual*, Second Edition.
Yale University and et.al (2008). *Yale Center for Environmental Law and policy*. Environmental Performance Index. EIA Online Learning Platform www.iisd.org/learning/eia.

Course Title: Disaster Management and Planning
Course Code: GEST-5103, Credit: 3, Full Marks: 75
Number of Classes: Approximately 24 (45 minutes class duration)

Course Description:
This course is concerned with the theoretical and applied aspects of disaster management and planning. It attempts to define disaster management and vulnerability, and to describe disaster risk reduction and disaster planning. This course would state how the Government of Bangladesh operates the organograms concerned with disaster management. It will also provide an overview of flood risk management practiced in Germany and the Netherlands. In addition, this course will highlight the role of UN sister organizations in disaster management worldwide including Bangladesh.

Course Learning Outcomes (CLOs):
CLO1: Able to describe the basic concepts of hazard, vulnerability, and disaster risk and management.
CLO2: Able to understand disaster management strategies.
CLO3: Able to explain the roles and responsibilities of government and non-governmental organizations including United Nations in disaster management.
CLO4: Able to analyze social structure, remote causes of vulnerability, and magnitude of hazard and hazard mapping.
CLO6: Able to formulate national policy to reduce vulnerability and hazard effects.

CLOs	Course contents	TLS	AS
CLO1	Disaster management: Terminology on disaster, nature, types and causes of disaster; global distribution of various disasters and impacts; approaches to disaster risk reduction.	Lecture, Handout, Group Discussion	Assignment, Tutorial, Terminal Examination and Final Examination
CLO1	Vulnerability: Concept and definitions; evolution and use of vulnerability in various disciplines; vulnerability models in disaster discourse, role of geography for vulnerability assessment.		
CLO2	Disaster management strategies: tools and techniques; rehabilitation.		
CLO3	Disaster management organogram in Bangladesh.		
CLO3 & CLO4	Government's measures for major natural hazards in Bangladesh: with some examples.		
CLO3 & CLO4	Flood risk management in developed countries: an overview on Germany and the Netherlands.		
CLO6	The UN and disaster management: the UN system; UN's sister organizations (especially OCHA) in disaster management.		
CLO6	Disaster planning: Disaster plan; content of disaster plan; problems of disaster plan implementation.		

TLS: Teaching-learning Strategy   AS: Assessment Strategy

References:

Adger, W.N. (2006). Vulnerability. *Global environmental change*, *16*(3), 268-281.

Birkmann, J. (2006). Measuring vulnerability to promote disaster-resilient societies: Conceptual frameworks and definitions. *Measuring vulnerability to natural hazards: Towards disaster resilient societies*, *1*, 9-54.

Carter, W.N. (1991). *Disaster management: a disaster manager's handbook*. ADB, Manila.

Coppola D.P. (2007). *Introduction to International Disaster Management*. ELSEVIER, China.

Foster, H. D. (2012). *Disaster planning: The preservation of life and property*. Springer Science & Business Media.

Islam, S.T., and Paul, A. (Eds.). (2019). *Geography in Bangladesh: Concepts, Methods and Applications*. Taylor &Francis.

Islam, N. (2005). *Natural hazards in Bangladesh. Disaster Research Training and Management Centre (DRTMC)*,University of Dhaka, Dhaka.

Schanze, J. et. al. edited (2006). *Flood Risk Management*. Springer, the Netherlands.

Shoeb, A. Z. M. and Aßheuer, T. (2008). NGOs in Bangladesh: some experiences to highlight flood management within the development framework. *The Journal of Geo-Environment*. 8, 14–29.

Shoeb, A. Z. M. and Moriruzzaman, Md. (2007). NGOs' Role in Flood Disaster Management in Bangladesh – A Case Study, *The Journal of Geo-Environment.* 7, 1–12.

Paul, S. K. (2013). Vulnerability concepts and its application in various fields: a review on geographical perspective. *Journal of Life and Earth Science*, *8*, 63-81.

Wisner B. et. al. (2004). *AT RISK: Natural hazards, people's vulnerability and disasters.* Routledge, London.

Course Title: Natural Disaster Forecast and Simulation
Course Code: GEST-5104, Credit: 3, Full Marks: 75
Number of Classes: Approximately 24 (45 minutes class duration)

Course Description:
This course is designed to provide an insight into the processes involved in natural disaster forecast and simulation. Process of disaster related data collection, preparation of data sets for disaster simulation, issues associated with simulation running, and collection of simulation outputs will be given special emphasis in this course. A detailed description and functioning process of various disaster forecasting techniques will be discussed in this course. Considering the importance of human role in disaster forecasting and warning, process of human perception integration will also be discussed thoroughly. Additionally, it includes a detailed information regarding natural disaster forecast and warning in Bangladesh.

Course Learning Outcomes (CLOs):
CLO1: Able to describe the concepts of disaster forecast and warning.
CLO2: Able to explain processes of disaster forecast and simulation locally and internationally.
CLO3: Able to investigate influences of data on forecasting accuracy.
CLO4: Able to assess various techniques for forecasting different natural disasters.

CLOs	Course contents	TLS	AS
CLO1	Disaster forecast: concepts, scope, necessity,limitation, and evolution.	Lecture, Discussion, Presentation, Assignment	Tutorial (quiz/ presentation/ assignments/exam), Terminal, Final examination
CLO2	Processes of disaster forecast and warning: data collection, forecasting, warning message dissemination, human response to warning, and human perception integration in forecasting and warning.		
CLO3	Processes of disaster simulation: selecting and preparing predictors for simulation, recording output from simulation, and forecasting accuracy assessment.		
CLO4	Disaster forecasting techniques: statistical techniques, GIS and remote sensing based techniques, Artificial Neural Network (ANN), based techniques.		
CLO2	Natural disaster forecasting and warning system in Bangladesh.		

TLS: Teaching-learning Strategy   AS: Assessment Strategy

References
Ban, R., Hallberg, R., and Sandgathe, S. (2016). *Next Generation Earth System Prediction: Strategies for Sub seasonal to Seasonal Forecasts*. National Academies Press.
Chan, J.C.L. and Kepert, J.D. (eds.) (2010). *Global Perspectives on Tropical Cyclones: From Science to Mitigation.World Scientific Series on Asia-Pacific Weather and Climate*. Vol. 4.
Asuka, S.P. (2012). *Uncertainties and Limitations in Simulating Tropical Cyclones*. Springer.
Mohapatra, M., Bandyopadhyay, B.K., Mohanty, A.T., Mohapatra, M., Singh, O.P., Bandyopadhyay, B.K., Rathore, L.S. (eds.). (2014). *Monitoring and Prediction of Tropical Cyclones in the Indian Ocean and Climate Change*. Springer.

Course Title: Application of Quantitative Techniques in Geography
Course Code: GESP- 5101, **Credit:** 2.0, **Full Marks**: 50
Unit: 0.5, **Credit: 2.0**, **Full Marks:** 50 (for General/Non-Thesis Program)
Unit: 0.125, **Credit: 0.5**, **Full Marks:** 12.5 (for Thesis Program)
Number of Classes: Approximately 15 (90 minutes class duration)

Course Description:
This course provides an in-depth application of various aspects of quantitative technique that are necessary for geographical, social and environmental data analysis. This course will provide hands on exercise on preparation of a questionnaire on selected geographical, environmental and social issues, and quantitative data collection through this questionnaire. Emphasis will be given on the process involved in the quantitative data coding, entry, processing, normalization, analysis and interpretation in the SPSS environment. Besides, major focus will be given on data normalization, recoding, conducting descriptive statistics, cross tabulation, multiple response analysis, correlation and regression.

Course Learning Outcomes (CLOs):
CLO1: Able to understand the nature and types of geographical, environmental and social data and application of appropriate statistical techniques.
CLO2: Able to determine sample size, data collection, and giving data entry into the SPSS environment.
CLO3: Able to apply descriptive statistical techniques, cross tabulation, multiple response analysis, parametric and non-parametric test, correlation and regression models.

CLOs	Course Contents	TLS	AS
CLO1	Understand the quantitative techniques, sampling and sample size determination, data nature, coding and entry.	Lecture, Discussion, Presentation, Hands on exercise	Lab exercise evaluation, Final Examination
CLO2	Data entry and management, variables creation and data input, data manipulation, transformation and recoding, data normalization, normal distribution curve, omitting errors and outliers.		
CLO3	Computing descriptive statistics such as frequency, mean, median, mode, measures of dispersion, variance, and coefficients.		
CLO3	Graphical presentation of data such as bar charts, pie charts, histogram, pentagon, hexagon and scatter plot etc.		
CLO3	Conducting cross tabulation and multiple response analysis.		
CLO3	Performing parametric and non-parametric tests such as t-test, Chi-square test, Z-test, F-test, ANOVA.		
CLO3	Conducting correlation, regression and principal component analysis.		

References:

Bowman, A., and Wilson, A. (Eds.). (2011). *Settlement, urbanization, and population* (Vol. 2). Oxford University Press, USA.
Matthews, J. A. (2013). *Quantitative and statistical approaches to geography: a practical manual*. Elsevier.
Bailey, A. (2014). *Making population geography*. Routledge, London.

Course Title: Map Study and Network Analysis
Course Code: GESP - 5102
Unit: 0.5, Credit: 2.0, Full Marks: 50 (for General/Non-Thesis Program)
Unit: 0.125, Credit: 0.5, Full Marks: 12.5 (for Thesis Program)
Number of Classes: Approximately 15 (90 minutes class duration)

Course Description:
This course provides an in-depth understanding of the analysis and interpretation of maps, with a focus on topographical and thematic maps of Bangladesh and selected countries. The course also delves into the study of cultural and land use aspects, settlement patterns, and communication networks. Furthermore, it introduces concepts and techniques of network analysis, emphasizing the role of networks in economic development. Topics include topological classifications, linear networks, and graph-theoretic measures such as centrality and shape.

Course Learning Outcomes (CLOs):
CLO1: Able to understand the topographical maps and their physical and cultural aspects, including land use, settlement, and communication networks.
CLO2: Able to explain topographical and thematic maps of Bangladesh and selected countries.
CLO3: Able to analyze and evaluate the topographical networks, including topology, graph theory, and network measures, to assess economic development indicators.

CLOs	Course Contents	TLS	AS
CLO1 & CLO2	Topographical maps of Bangladesh and other countries. Study of cultural aspects with special reference to land use, settlement and communication networks.	Lecture, Discussion, Presentation, Hands on exercise	Lab exercise evaluation, Final Examination
CLO2 & CLO3	Study of land utilization maps of selected countries.		
CLO2 & CLO3	Network analysis: Topological classification, linear networks, elementary graph theoretic measures of structure, centrality and shape. Network as index of the economic development.		

References:
Black, J. (2018). *Urban Transport Planning: Theory and Practice*. Routledge.
Hatzopoulos, J.N. and Hatzopoulos, D.J. (2024). *Topographic Mapping: Covering the Wider Field of Geospatial Information Science & Technology (GIS&T)*. Universal-Publishers.
Meyer, M. D. (2016). *Transportation Planning Handbook*. John Wiley & Sons.
Rodrigue, J.P., Comtois, C. and Slack, B. (2013). *The Geography of Transport Systems*. 3rd edition, Routledge, New York, USA.
Salisbury, R.D. and Atwood, W.W. (1908). *The Interpretation of Topographic Maps* (No. 60). US Government Printing Office.

**Detailed Course Curriculum for the
General/Non-Thesis and Thesis Group
MS Programs, 2nd Semester**

GEST 5205	Geography and Migration and Refugee Management
GEST 5206	Regional Planning Techniques
GEST 5207	Urban Planning
GEST 5211	Remote Sensing for Coastal and Marine Environmental Management
GESP 5203	Application of Advance GIS and Remote Sensing Techniques[*]
GESP 5204	Micro-region Survey, and Preparation of Weather and Climate Map[*]
GESF 5201	Field Work[**]
GESV 5201	Viva-voce

COURSES	TOTAL CREDITS	TOTAL MARKS
THEORY COURSES	12.0	300
PRACTICAL COURSES[*]	4.0/1.0[*]	100/25[*]
FIELD WORK[**]	2.0	50
VIVA-VOCE	2.0	50
TOTAL	20.0/15 (THESIS)	500/375 (THESIS)

[*]The number of theoretical courses and credits is identical for both the General/Non-Thesis and Thesis Group MS Programs. However, while the number of practical courses is also the same for both programs, the total assigned credits differ: 4 credits for the General/Non-Thesis MS Program and only 1 credit for the Thesis Group MS Program.
[**] No field work for Thesis Group MS Program

Course Title: Geography of Migration and Refugee Management
Course Code: GEST-5205, **Credit:** 3, **Full Marks:** 75
Number of Classes: Approximately 24 (45 minutes class duration)

Course description:

The course delves into migration and refugee management, including migration theories, data analysis, various types of migration, and national and global migration policies. Additionally, it offers population redistribution, gender dynamics, poverty issues, and internal displacement within migration contexts. Furthermore, it aims to enhance comprehension of migration and refugee management in relation to geographical variations.

Course Learning Outcomes (CLOs):
CLO1: Able to state the concept, theories and models of migration and refugees, and key characteristics.
CLO2: Able to understand determinants, causes and consequences of migrations, and internal displacement.
CLO3: Able to explain the types and trend of global migration and refugees.
CLO4: Able to analyse migration data and statistics.
CLO5: Able to asses population distribution, migration policies, environmental migration and refugee problems.

CLOs	Course content	TLS	AS
CLO1	Migration: concept and definition, scope of migration studies, classification, typologies and selectivity of migration.	Lecture, Discussion, Presentation, Assignment	Tutorial (quiz/ presentation/ assignments/exam), Terminal, Final examination
CLO4	Data and Statistics: sources of data, nature of migration data and migration estimation procedure.		
CLO1	Theoretical Aspects of Migration Studies: Ravenstein's Law. Lee's hypothesis and Stouffer's intervening opportunity model. Mabugunj system approach and zelinisky'smobility Hypotheses		
CLO2 & CLO3	Internal Migration: determinants, types, causes and consequences. International Migration: types, causes and consequences, selecting migration and overseas migration from Bangladesh.		
CLO2 & CLO5	Migration Policies: definitions, aims, objectives, historical background, migration policies in developed and developing countries, gender and poverty issues in migration. Population Redistribution: internal and international redistribution of population, refugee and labour migration. Problems of urbanization. Internal displacement problems.		
CLO5	Environmental migration and Refuge Problems - mitigation adaptation and management.		

TLS: Teaching-learning Strategy   AS: Assessment Strategy

References:

Samers, M. (2010). *Migration (Key Ideas in Geography).* Routledge, UK.

Robinson, V. (1996). *Geography and Migration.* Brookfield., UK, Elgar, US.

Newbold, K. B. (2010). *Population Geography: Tools and Issues.* Rowman & Littlefied Publisher, London.

Clarke, J. I. (1966). *Population Geography,* Pergamon Press, London

Course Title: Regional Planning Techniques
Course Code: GEST-5206, **Credit:** 3, **Full Marks:** 75
Number of Classes: Approximately 24 (45 minutes class duration)

Course description:
The course includes the basic concepts of region, origin, and evolution of regions, as well as regional planning as a discipline, including its contemporary applications. It will comprise three fundamental aspects of regional planning: database and its attributes, transport network analysis, and estimation of population. This course considers the interaction between economic development processes and regional planning through spatial development model analysis, drawing upon examples from Bangladesh, China, South Korea, and Japan. It will also examine policies and processes of regional planning, sustainable regional planning, and regional planning's role in global connectivity.

Course Learning Outcomes (CLOs):
CLO1: Able to understand the concept of region and regional planning, methods and techniques of regional planning, theories and models related to regional planning.
CLO2: Able to explain different spatial development theories and models, transportation planning and their application to economic and regional development.
CLO3: Able to analyze development of economic system and interaction between urban centers and rural development, growth poles and growth centers development, contribution of regional planning in rural-regional development.

CLOs	Course Contents	TLS	AS
CLO1	Introduction i) Concept of region, planning and regional planning. ii) Nature, types, component and factors of region and regional planning. iii) National versus regional planning- regional hierarchy and multi-level planning	Lecture, Discussion, Presentation, Assignment	Tutorial (quiz/ presentation/ assignments/exam), Terminal, Final examination
CLO1 & CLO2	Spatial Models of Regional Planning Physical and land use theories and models: Von Thunen's isolated state, Central place theory, Losch Model Rural-Urban relation in a Macro-Spatial Development Framework Model (South Asia, South- east Asia, China, South Korea, Japan). Gravity, potential, and spatial interaction models		
CLO1 & CLO2	Data Base for Regional Planning Definition, necessity and level of database. ii) Organizing a database (sources and types). iii) Data attributes and problems associated with the planning related database. iv) Integrated database system.		
CLO1 & CLO2	Regional Transportation Planning i) Concept and importance of transportation planning. ii) Traffic volume, speed, travel time, parking, relation between flow parameters. iii) Origin-destination survey. iv) Trip generation, distribution, assignment and modal split. v) Traffic management: principles and approaches.		

CLO1 & CLO2	Methods of population forecasts and projections i) Meaning, types and importance of population projections Techniques of population projection: Arithmetic progression, Geometric progression, Gibbs method, Registrar General of India method, Regression analysis.		
CLO3	Methods and Techniques of Regionalization i) Steps and purpose of regionalization. ii) Delineation of formal regions: Weighting techniques and Factor analysis. iii) Delineation of functional regions: Flow analysis and gravity analysis. iv) Delineation of planning regions: Theissen Polygon method, Distance Minimization technique, discrimination Analysis and Graph Theory Method. Other techniques of regional delimitation.		
CLO3	Development Strategies and policy implications i) Regional development: theories and levels of development, stages of development, cumulative development in space; center-periphery relationship. ii) The role of growth and service centers for rural development. iii) Rural Backwardness and Regional problems: Inter and Intra-Regional Inequalities. iv) Rural-urban disparities, linkages and opportunities. The UFRD (Urban Functions in Rural Development) approach. v) Agropolitan planning approach. Regional development policies and its relevance: Review of regional development planning, assessing policies and policy making in decentralized planning.		

TLS: Teaching-learning Strategy   AS: Assessment Strategy

References:
Anson, R.W. and Ormeling, F.J. (Edt.) (1984). *Basic cartography: 1.* Basic cartography: for students and technicians. Elsevier applied sciences publishers.
Berry, B. J. L., Conkling, E. C., and Ray, D. M. (1976). *The geography of economic systems.* Englewood Cliffs, Prentice-Hall, N.J.
ESCAP, (1975). *Guidelines for Preparing Sub national Population Projection.* UNO, ESCAP.
Haggett, P., Cliff, A. D., and Frey, A. (1977). *Locational analysis in human geography.* Arnold, London.
Hutchinson, B.G. (1974). *Principles of Urban Transport Systems Planning.* McGraw-Hill Books, New York.
Isard, W. (1982). *Methods of regional analysis: An introduction to regional science.* New York.
Jain, A. K. (2009). *Urban transport: Planning and management.* A.P.H. Pub. Corp, New Delhi.
Kadiyali, L.R. (2013). *Traffic Engineering and Transport Planning* (8th ed.). Khanna Publishers, Delhi.
Papacostas, C. S., and Prevedouros, P. D. (2012). *Transportation engineering and planning.* PHI Learning, New Delhi, India.
Rogers, A. (1985). *Regional population projection models.* Sage Publications, Beverly Hills.
Routray, J. K. (1990). *Data base: An aid to GIS application for decentralized micro-level planning in developing countries: Indian experience.* Division of Human Settlements Development, Asian Institute of Technology. Bangkok, Thailand:
Smith, D. M. (1981). *Industrial location: An economic geographical analysis.* Wiley, New York.

Course Title: Urban Planning
Course Code: GEST-5207, **Credit:** 3, **Full Marks:** 75
Number of Classes: Approximately 24 (45 minutes class duration)

Course Description:
This course explores important substantive areas and concepts in the field of urban planning and its policy issues. This course will introduce to the learner to understand theories and principles of urban planning, urban design and land use planning. It seeks to equip the student with the fundamental knowledge and language required for understanding the planning and design of economically viable, environmentally sustainable for the safe and resilient communities. This course and its content will allow student to better understand how planning and design principles and practices have developed overtime, including the implications of ethics within the planning profession and an evaluation of future projections.

Course Learning Outcomes (CLOs):
CLO1: Able to describe the various fields of planning, such as, urban and regional planning, land use zoning plan, land use planning, residential planning, transportation planning, environmental planning etc.
CLO2: Able to understand the major debates and issues in urban planning policy for the current and future predictions of urban planning.
CLO3: Able to apply current knowledge, evidence, concepts and theory related urban planning.
CLO4: Able to analyze different planning issues critically and investigate the relationship between geographical aspects and urban planning components using different urban models and theories.

CLOs	Course Contents	TLS	AS
CLO1	Introduction to Urban Planning: Definitions, aims & objectives of urban Planning.	Lecture, Discussion, Presentation, Assignment	Tutorial (quiz/ presentation/ assignments/exam), Terminal, Final examination
CLO1 & CLO2	Evolution and Emergence of Urban Planning & Theoretical Model Evolution of urban planning, emergence of modern cities, Garden city, Geddisian triad, and Radburn's city.		
CLO2 & CLO3	Theoretical Perspective of Central Business District (CBD). Satellite Towns & New Towns. Urban renewal. Community development. Smart City growth. Compact development, Green building, and sustainable urban development		
CLO3 & CLO4	Urban Planning Principles: Statement of Urban Planning; Priority Areas of Urban Planning: Zoning, Green Belt, Housing, Public Buildings, Recreation Centres, Road Systems, Transport Facilities, Market Facilities. Sustainable Urban Planning Principles: Environmental Quality and Ecological Restoration; Land Development and Integration of Urbanization and Industrialization; Livable and Healthy Cities; Environmental Protection and Resources Recycling; Social Inclusiveness and Cultural Promotion.		
CLO1 & CLO4	Methods and Implementation of Urban Planning: Steps in urban planning, cyclic process of planning, methods & tools of urban planning, urban planning for the future, implementation of urban planningand zoning plan.		

CLO3 & CLO4	Urban Planning in Bangladesh: Evolution of urban planning and its authorities in Bangladesh. BNBC, NHP, DMDP, Structure Plan, DAP and master plan.		

TLS: Teaching-learning Strategy   AS: Assessment Strategy

References:

Bandopadhyay, A. (2000). *Text book of Town Planning*. Books and Allied, Calcutta.

Freund, W.I., (1968). *Principles and Practice of Urban Planning: Municipal Management Series*. Int. City Managers Association.

Levy, J.M. (2009). *Contemporary Urban Planning*. Prentice Hall Inc., NJ.

Margaret, R. (1974). *An Introduction to Town Planning Techniques*. Hutchinson.

Ratcliffe, J. (1981). *An Introduction to Town and Country Planning*, Hutchinson.

Rondolph, J. (2003). *Environmental Land use Planning and Management*. Island Press, Washington DC.

Salingaros, N.A. (2005). *Principles of Urban Structure* (Design/Science/Planning), Tecne Press.

UN-HABITAT, (2016). *Guidelines for Urban Planning-Prepared for the Republic of the Union of Myanmar*.

Course Title: Remote Sensing for Coastal and Marine Environment Management
Course Code: GEST-5211, **Credit:** 3, **Full Marks:** 75
Number of Classes: Approximately 24 (45 minutes class duration)

Course Description:
This course aims to provide a deep insight into how satellite remote sensing is used in the coastal and marine environment. This course will introduce the application of active and passive remote sensing for marine and coastal environments. The importance of sea surface temperature, ocean color, coral reefs, land use, and land cover monitoring will also be emphasized. Additionally, it includes a detailed description and functioning process of various methods for identifying shoreline dynamics. Upon completion of this course the participants are expected to implement satellite remote sensing technologies for the sustainable management of coastal and marine environment.

Course Learning Outcomes (CLOs):
CLO1: Able to acquire a new perspective about the view of the coastal and marine environment provided from satellites to enhance the knowledge of the coastal and marine environment.
CLO2: Able to understand/discuss the processing steps of remotely sensed data using a variety of manual and automated techniques and discover some of the specific ways in which satellite coastal and marine data make unique contributions to coastal and marine environmental science.
CLO3: Able to assess image acquisition and platforms, image characteristics identification, image processing, and data set manipulations and to the strengths and weaknesses of remote sensing instruments for coastal and marine environment.
CLO4: Able to apply knowledge and critical thinking skills to solve a real-world problem for coastal and marine environment with appropriate remote sensing data and processing methods.

CLOs	Course Contents	TLS	AS
CLO3	Introduction to Active and passive remote sensing of marine and coastal environment: LiDAR/Radar remote sensing, hyperspectral remote sensing, high spatial-resolution remote sensing, and remote sensing and in-situ measurements.	Lecture, Discussion, Presentation, Assignment	Tutorial (quiz/ presentation/ assignments/exam), Terminal, Final examination
CLO1 & CLO2	Sea surface temperature: Method of sea surface temperature monitoring using remote sensing, studies of ocean eddies and fronts, monitoring global sea surface temperature patterns with special focus on the Bay of Bengal.		
CLO1 & CLO2	Ocean color monitoring: Importance of real-time monitoring. Coastal and ocean products from ocean color, and ocean color products for operational use.		
CLO1 & CLO2	Remote sensing of coral reefs: Remote sensing to assess coral bleaching and coral reef biodiversity.		
CLO2 & CLO4	Land use and Land cover: Coastal area land use and land-cover change analysis, effects of land-use/land- cover change in coastal areas.		
CLO3	Remote sensing of shorelines: Application of different methods for		

& CLO4	identifying shoreline dynamics.			

TLS: Teaching-learning Strategy   AS: Assessment Strategy

References:
Wang, Y. (2009). *Remote Sensing of Coastal Environments*. CRC Press, New York, USA.
Miller, R.L., Del Castillo, C.E., and McKee, B.A. (Eds.). (2005). *Remote sensing of coastal aquatic environments* (Vol. 511). Springer, Netherlands.
Rani, M., Seenipandi, K., Rehman, S., Kumar, P. and Haroon, S. (Eds.). (2021). *Remote Sensing of Ocean and Coastal Environments*. Elsevier, Amsterdam, Netherlands.

Course Title: Application of Advanced GIS and Remote Sensing Techniques in Geography and Environment

Course Code: GESP - 5203
Unit: 0.5, **Credit: 2.0**, **Full Marks:** 50 (for General/Non-Thesis Program)
Unit: 0.125, **Credit: 0.5**, **Full Marks:** 12.5 (for Thesis Program)
Number of Classes: Approximately 15 (90 minutes class duration)

Course Description:

This course offers an in-depth exploration of advanced techniques in remote sensing and image analysis, equipping students with practical skills and theoretical knowledge to process, analyze, and interpret satellite imagery for diverse environmental and geospatial applications. Designed for students in remote sensing, environmental science, and geospatial analysis, this course integrates theory with hands-on exercises, preparing participants for cutting-edge research and real-world applications in sustainable development and environmental monitoring.

Course Learning Outcomes (CLOs):

CLO1: Able to understand the processing steps of remotely sensed data using a variety of manual and automated techniques.
CLO2: Able to assess image acquisition and platforms, image characteristics identification, image processing, and data set manipulations and to the strengths and weaknesses of remote sensing instruments.
CLO3: Able to apply knowledge and critical thinking skills to solve a real-world problem with appropriate remote sensing data and processing methods.
CLO4: Able to analyze satellite data for land and ocean parameters for better understating of the environment.

CLOs	Course Contents	TLS	AS
CLO1 & CLO2	Techniques of image fusion and image filtering for image enhancement.	Lecture, Discussion, Presentation, Hands-on exercises	Lab exercise evaluation, Final examination
CLO1 & CLO3	Image classification using non-parametric image classifiers such as artificial neural networks.		
CLO1 & CLO3	Generation of different kinds of band ratios and vegetation indices from different satellite data.		
CLO3 & CLO4	Techniques of trend analysis of LST and vegetation parameters i.e. NDVI, EVI and so on.		
CLO3 & CLO4	Satellite data for ocean parameters (such as SST, Chlorophyll a, salinity and ocean current) analysis.		

References:

Campbell, J. B. (2007). *Introduction to Remote Sensing*. Guildford Press.

Jensen, J.R. (2004). *Introductory Digital Image Processing: A Remote Sensing Perspective*. Prentice Hall

Lillesand, T.M., Kiefer, R.W. and Chipman, J.W. (2004). *Remote Sensing and Image Interpretation*. Wiley. (Wiley Student Edition).

Wolf, P.R. and Dewitt, B.A. (2000). *Elements of Photogrammetry: With Applications in GIS*. McGraw- Hill.

Wang, Y. (2009). *Remote Sensing of Coastal Environments*. CRC Press, New York, USA.

Miller, R.L., Del Castillo, C.E., and McKee, B.A. (Eds.). (2005). *Remote sensing of coastal aquatic environments.* (Vol. 511). Springer, Netherlands.

Rani, M., Seenipandi, K., Rehman, S., Kumar, P. and Haroon, S. (Eds.). (2021). *Remote Sensing of Ocean andCoastal Environments*. Elsevier, Amsterdam, Netherlands.

Course Title: Micro-region Survey and Preparation of Weather and Climate Maps
Course Code: GESP - 5204
Unit: 0.5**, Credit: 2.0**, **Full Marks:** 50 (for General/Non-Thesis Program)
Unit: 0.125**, Credit: 0.5**, **Full Marks:** 12.5 (for Thesis Program)
Number of Classes: Approximately 15 (90 minutes class duration)

Course Description: Study in microregional survey provides the hand on knowledge of conducting field work, land use map, networking and field of conduct with respondents. This ultimately developed the skills of research design, data collections and data input, data analysis and interpretation of results. On the other hand, the preparation of weather and climatic maps is expected to provide students with a through grasp of how to analysis weather data variables and produce different kinds of weather maps, interpretation of the data and change detection of the atmospheric conditions.

Course Learning Outcomes (CLOs):

CLO1: Able to understand the process and methods of conducting micro region survey.
CLO2: Able to assess distinct patterns in the data collected through survey and explain socio-physical condition of the surveyed area.
CLO3: Able to explain meteorological conditions by interpreting meteorological data collected through different platforms.
CLO4: Able to analyze weather conditions at local, national and global scales and prepare maps based on that analysis.

CLOs	Course Contents	TLS	AS
CLO1 & CLO2	Micro-region survey	Lecture, Discussion, Presentation, Hands-on exercises	Lab exercise evaluation, Final examination
CLO1 & CLO3	Collection of data necessary for weather and climate map generation		
CLO1 & CLO3	Preparation of local, national, synoptic and global scales weather maps		

References:

Colling, R. L. (1999). *Flying the Weather Map*. Aviation Supplies and Academics Inc., Newcastle.
Harrelson, C.C., Rawlins, C.L. and Potyondy, J.P. (1994). *An Illustrated Guide to Field Technique*. Technical Report: US Department of Agriculture. Available at: https://research.fs.usda.gov/treesearch/20753
Robert, H. Stoddard., (1982). *Field Techniques and Research Methods in Geography*. Kendall/Hunt Publishing Company, University of Michigan.
Vasquez, T. (2023). *Weather map handbook: A complete guide to weather charts in the 2020s*. Fourth Edition. Weather Graphics Technologies, Texas.
Vasquez, T. (2002). *Weather Analysis & Forecasting Handbook*. Weather Graphics, Texas.

Detailed Course Curriculum for of the
Thesis Group
MS Programs, 3rd Semester

GESD/T 5301	Dissertation/Thesis
GESDP 5301	Thesis Defense/Presentation

COURSES	TOTAL CREDITS	TOTAL MARKS
Dissertation/Thesis	6.0	150
Thesis Defense/Presentation	2.0	50
TOTAL	8.0	200

Course Title: Dissertation/Thesis
Course Code: GESD/T 5301, **Credit:** 6, **Full Marks:** 150
Number of Classes: As required for the research

- Students must conduct research on their chosen topic.
- Contact the supervisor regularly to update him/her on the work progress.
- Prepare a dissertation/thesis based on the research findings.
- Submit the dissertation/thesis to their supervisor for review and approval.
- Submit the approved dissertation/thesis to the examination committee for final evaluation.

Course Title: Thesis Defence/Presentation
Course Code: GESDP 5301, **Credit:** 2, **Full Marks:** 50

- Students need to prepare presentation slides based on the outcomes of their research.
- Present their findings in front of the examination committee and other audience members.
- Respond to questions from the examination committee members and the audience.
- Make necessary corrections as directed by the examination committee.

⚟ THE END ⚟