# HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
## (A Central University)

**NEP-2020 BASED**

**Revised Curriculum and Syllabus**

**of**

# M.Sc. Remote Sensing & GIS Applications

**(w.e.f. 2025-26)**

**DEPARTMENT OF REMOTE SENSING & GIS APPLICATIONS**

**SCHOOL OF EARTH SCIENCES**

# VISION AND MISSION

## Vision and Mission of the University

## VISION

To achieve excellence by empowering all stakeholders through promotion of innovations in the field of higher education by imparting training and education, and encouraging research for the development of the country with specific attention to the mountain region.

## MISSION

- To stimulate the academic environment for promotion of holistic learning and research and contribute to the nation's growth.
- To inculcate values and impart skills for shaping able and responsible individuals committed towards the intellectual, academic and cultural development of society.

## About the Course

The primary goal of this course is to equip students with a good understanding of remote sensing fundamentals, including components, platforms, and sensors. Students will learn about data acquisition, storage, and transmission processes. Additionally, the course covers advanced remote sensing techniques such as Hyperspectral, LiDAR, Thermal, and Microwave data analysis. These skills find applications in various fields like earth science, environmental monitoring, agriculture, forestry, water resource management, urban planning, and climate change studies. Furthermore, students will gain knowledge in fundamental and advanced Geographic Information Systems (GIS) techniques, photogrammetry, geostatistics, digital surveying, and navigational systems. They will explore both commercial and open-source software tools for data processing and analysis. The course includes field studies to train students in ground data collection, validation, and community outreach. Finally, students will gain hands-on experience by executing research projects, resource mapping, and monitoring during their end-of-semester assessments.

## Program Outcomes (Pos)

**The students should have the ability to:**

**PO1:** Independently carry out investigation and development work to solve geospatial problems.

**PO2:** Write and present a technical report/document/research article at international level.

**PO3:** Demonstrate the perfection in Remote Sensing & GIS Applications.

**PO4:** Share theoretical and practical knowledge in teaching/research/industries.

**PO5:** Apply professional ethics, accountability and equity.

## Program Specific Outcome (PSO)

The post-graduate students shall be able to realise the following specific outcomes by the end of programme:

| NUMBER | PROGRAMME SPECIFIC OUTCOMES |
|---|---|
| **PSO-1** | A deep knowledge of aerial photographs, satellite images, and digital image interpretation has been found as an indispensable tool in topographical mapping which enables students to extract all necessary interpretations from the images. |
| **PSO-2** | Developing a broad conceptual understanding along with practical exploration of the concept of detecting and monitoring the physical characteristics of an area through Remote Sensing, GIS, Cartography and GNSS in geospatial studies. |
| **PSO-3** | Exploring the concept and application of geospatial data, Web-GIS and the role of geoinformatics in disaster and natural resource management, will be useful for planning purposes. |

| | |
|---|---|
| **PSO-4** | Developing the concept of law and policy making and utilisation of geospatial data will make students aware of constraints in the field of geospatial analysis. |
| **PSO-5** | Students will be able to understand the current trends in the fields of GIS and remote sensing. As the understanding of remote sensing gets better, students will learn about thermal, hyperspectral, microwave, LIDAR, and UAV technologies. |
| **PSO-6** | Geoinformatics is now being used in the fields of master planning, smart city development, water resources, environments, and forest management. |

## Course Structure

i) **The duration of the Master's programme in Remote Sensing and GIS Applications shall be structured into four semesters across two academic sessions.** The first academic session will include the first and second semesters, while the second academic session will comprise the third and fourth semesters. *(Refer to the Programme Structure section for details.)*

ii) The minimum attendance required by a candidate will be as per university rules.

iii) Each of Ist, IInd and IIIrd Semester shall consist of THREE Discipline Specific Core courses, ONE Practical course and ONE Discipline Specific Elective course. Fourth semester shall have ONE Discipline Specific Core courses, ONE Practical course and ONE Discipline Specific Elective course and the Project II/ Dissertation. Further, First, and Second semesters shall have Remote Sensing Field Work-I (GPS Survey) and Remote Sensing Field Work-II (Ground Truth) respectively, while the third semester will have courses related to their specialized streams.

## Mode of M.Sc. Programme in Remote Sensing and GIS Applications

- Regular

## Medium of Instruction

- Should be English only

## Evaluation

I. Two sessional tests of continuous internal assessment 40%

2 End semester (Terminal) Exams 60%

- Continuous internal assessment may include objective tests, written tests, assignment, paper presentation, participation in class group discussion and laboratory work etc.; suitable to the course paper presentation should be given priority and presentation must be one of the important methods of internal assessment.

- Weightage of 2 marks for attendance component out of 40 marks for continuous assessment shall be available only to those who attend 75% and more of classroom theory and practical.

i) 76% attendance and above up to 85% : 2marks

ii) above 85% : 3 marks

- For all courses/paper (core and elective) the credit has been mentioned in the course structure section. End semester exam will be 02 hours duration.

The student shall have to pass separately each of the theory courses, laboratory courses, fieldwork, project work and the internal assessments (theory and laboratory).

A candidate for a pass in each semester Examination shall require to obtain:

- At least 40% marks or requisite Grade (as per CBCS norms) in the aggregate of the paper prescribed for the examination
- At least 40% marks in the practical's or requisite Grade (as per CBCS norms)

**Remote Sensing Field Work: -**

Remote sensing Field work/training is an integral part of this Course. As such, the students of M.Sc. 1st, IInd and IIIrd Semesters are advised to undergo field work separately in each academic session to acquire comprehensive and detailed field training in various aspects, such as GPS survey, field checking, ground truth studies and visit to various national remote sensing laboratories. In the second semester, students (***Student on exit after successfully completing the first year of a two-year PG programme***) are encouraged to submit **Research Project-I** that includes a field survey on local phenomena/issues/problems specific to the Garhwal region/Uttarakhand within their respective specialization. At the end of the above field work, each student will be required to submit the field report covering all aspects for evaluation, normally within two weeks after the completion of the field work. The evaluation based on field work report, and viva - voce shall be done by the External Examiner/Teacher In-Charge of the Field Work and Head.

Any student failing to undergo /complete his /her Field Work & Training/Internships due to major setback such as severe or prolonged illness/ death of the nearest kith and kin shall be allowed, with the permission of Vice - Chancellor, a second chance. The student shall have to carry out, at his /her own cost, the field work in any of the area /aspect in and around Garhwal regions, as assigned by the Head and submit his/her field report for evaluation and appear at viva - voce examination along with his / her batch of students of the same year.

**Research Project-II: -**

The subject/topic of the Project Work, related to the problems/ applications of Geospatial technology, will be allotted to each student at the beginning of the M.Sc. IVth

Semester. The students, in consultation with their respective supervisors, may give their choice of preference of problem /topic/area. However, the decision of the Head shall be final. Each student will be required to work independently on the problem assigned including literature consultation, data collection, fieldwork and/or training, laboratory investigations, report writing etc., under the guidance of his/her supervisor. Students may also be permitted to carry out their dissertation works in an outstation institution at their own expenses but he/she will have to follow the rules and regulations decided by the department. The students will submit one (bound) synopsis report and three typed (bound) copies of his/her work to the department, in the form of Project Report. After the evaluation, a copy of which will be returned to the concerned supervisor and the student separately *(Refer to the Programme Structure section for details pp10.).*

**Programme Structure in Accordance with National Education Policy - 2020**

**With Multiple Entry and Multiple Exit Options**

**M.Sc. in Geoinformatics First Year (NHEQF Level 6)**

| Sl. No. | Course Category | Course Code (T=Theory, P=Practical) | Course Title | Credits (I=Internship, D= Dissertation) | | | |
|---|---|---|---|---|---|---|---|
| | | | | T | P | I/D | Total Credits |
| **Semester I** | | | | | | | |
| 1 | Discipline Specific Core | DSC T101 | Aerial Photography & Digital Photogrammetry | 5 | 0 | 0 | 5 |
| 2 | | DSC T102 | Fundamentals of Remote Sensing | 5 | 0 | 0 | 5 |
| 3 | | DSC T103 | Geographical Information System (GIS) | 5 | 0 | 0 | 5 |
| 4 | | DSC P104 | Lab Course- I | 0 | 3 | 0 | 3 |
| 5 | Discipline Specific Elective (Any **ONE** within the list) | DSE TP105 | Thermal and Microwave Remote Sensing | 4 | 2 | 0 | 6 |
| | | DSE TP106 | Basic Programming Concepts | | | | |
| | | DSE TP107 | Environmental Monitoring & Assessment | | | | |
| | **Total Credits (A)** | | | 19 | 5 | 0 | 24 |
| **Semester II** | | | | | | | |
| 6 | Discipline Specific Core | DSC T201 | Digital Image Processing (DIP) | 5 | 0 | 0 | 5 |
| 7 | | DSC T202 | Digital Cartography & GPS | 5 | 0 | 0 | 5 |
| 8 | | DSC T203 | Statistics for Geospatial Studies | 5 | 0 | 0 | 5 |
| 9 | | DSC P204 | Lab Course- 2 | 0 | 3 | 0 | 3 |
| 10 | Discipline Specific Elective (Any **ONE** within the list) | DSE TP205 | Internship/Industrial Training** with MOOC* | 4 | 2 | 0 | 6 |
| | | DSE TP206 | Programming for Geospatial Analysis | | | | |
| | | DSE TP207 | Research Project-I# | | | 6# | |
| | **Total Credits (B)** | | | 19 | 5 | | **24** |

**Note(s):**

| | |
|---|---|
| •Theory Lectures **60** Minutes Each and Practical Lectures **120** Minutes Each | • Total Credits for M.Sc.: **96**<br>NHEQF Level 6: Semester I & II |
| •DSC- Discipline Specific Core<br>•DSE- Discipline Specific Core<br>•SC- Skill-based Courses<br>*MOOC Courses must be **Postgraduate Level** and related to the subject of Geoinformatics.<br># Research Project-I can be selected only for candidates who want to exit after successful completion of the first year/ two semesters at NHEQF Level 6 with a Post Graduate Diploma in Remote Sensing & GIS Applications. Students are required to present their project findings and submit report in a structured format (Detailed guidelines available in the Department). | Theory and Practical examinations will be conducted at the end of the respective semester.<br>•Practical courses may be divided into sub-sections. |
| • **Requirement for Entry at NHEQF Level 6:** Completed 3-year Bachelor's degree (minimum 120 credits) or 4-Year Bachelor's Degree (In case of B.Tech and B.E Programme-Minimum-160 credits) and candidates who have met the entrance requirements, including specified levels of attainment, in the programme admission regulations. | |
| • **Requirement for Exit after successful completion of the first year, NHEQF Level 6:** ***Student on exit after successfully completing the first year of a two-year PG programme (i.e., securing a minimum of 48 credits will be awarded a "Postgraduate Diploma in Remote Sensing & GIS Applications.*** | |
| • **Internship/Industrial Training (**during summer vacation)- Applicable only for a student who wants to continue the M.Sc. program in *Remote Sensing & GIS Applications* for two years/four semesters.** | |
| • **Entry Option for M.Sc. NHEQF Level 6.5: Upon successful completion of the P. G. Diploma in Remote Sensing & GIS Applications/Geoinformatics related with a minimum of 40 credits, students are eligible for direct admission to the second year (third semester) of the M.Sc. program in Remote Sensing & GIS Applications and candidates who have met the entrance requirements, including specified levels of attainment, in the programme admission regulations.** | |

**Structure in Accordance with National Education Policy - 2020**

**With Multiple Entry and Multiple Exit Options**

**M.Sc. in Geoinformatics Second Year (NHEQF Level 6.5)**

| Sl. No. | Course Category | Course Code (T=Theory, P=Practical) | Course Title | Credits (I=Internship, D= Dissertation) | | | |
|---|---|---|---|---|---|---|---|
| | | | | T | P | I/D | Total Credits |
| **Semester III** | | | | | | | |
| 11 | Discipline Specific Core | DSC T301 | Sustainability & Geospatial Technology | 5 | 0 | 0 | 5 |
| 12 | | DSC T302 | Geospatial Modelling & Decision Support System | 5 | 0 | 0 | 5 |
| 13 | | DSC T303 | Research Methodology & Academic Writing | 5 | 0 | 0 | 5 |
| 14 | | DSC P304 | Lab Course- 3 | 0 | 3 | 0 | 3 |
| 15 | Discipline Specific Elective (Any **ONE** within the list) | DSE TP305 | Application of Geoinformatics in Geoscience | 4 | 2 | 0 | 6 |
| | | DSE TP306 | Application of Geoinformatics in Hydrology & Watershed Management | | | | |
| | | DSE TP307 | Application of Geoinformatics in Urban Development & Planning | | | | |
| | | DSE TP308 | Application of Geoinformatics in Natural Resource Management | | | | |
| **Total Credits (C)** | | | | 19 | 5 | 0 | **24** |
| **Semester IV** | | | | | | | |
| 16 | Discipline Specific Core | DSC T401 | Application of Geoinformatics in Climate Change Studies | 5 | 0 | 0 | 5 |
| 17 | | DSC T402 | Research Project-II/Dissertation## | 0 | 0 | 10 | 10 |
| 18 | | DSC P403 | Lab Course- 4 | 0 | 3 | 0 | 3 |
| 19 | Discipline Specific Elective (Any **ONE** within the list) | DSE TP404 | Application of Geoinformatics in Disaster Management | 4 | 2 | 0 | 6 |
| | | DSE TP405 | Advance Geospatial Data Collection Techniques | | | | |
| **Total Credits (D)** | | | | 9 | 5 | 10 | **24** |
| **Total Credits (A+B+C+D)** | | | | | | | **96** |

**Note(s):**

| | |
|---|---|
| •Theory Lectures **60** Minutes Each and Practical Lectures **120** Minutes Each | • Total Credits for M.Sc.: 96<br>NHEQF Level 6.5: Semester III & IV |
| •DSC- Discipline Specific Core<br>•DSE- Discipline Specific Core | Theory and Practical examinations will be conducted at the end of the respective semester.<br>•Practical courses may be divided into sub-sections. |
| **• Entry Option for M.Sc. NHEQF Level 6.5: Upon successful completion of the P. G. Diploma in Remote Sensing & GIS Applications/Geoinformatics related with a minimum of 40 credits, students are eligible for direct admission to the second year (third semester) of the M.Sc. program in Remote Sensing & GIS Applications and candidates who have met the entrance requirements, including specified levels of attainment, in the programme admission regulations.** | |
| **• Student on successfully completing two-year PG programme (i.e., securing minimum required 96 credits) will be awarded "Postgraduate Degree", in related field/discipline/subject.** | |
| ## General Guidelines for Students who want to pursue their dissertation outside of the University Campus/Department:<br>1. The supervisor must be from the parent department. They can choose a co-supervisor from another organisation/institution/department.<br>2. The co-supervisor must have knowledge or research experience in the field of Geoinformatics.<br>3. Research institutions/Organisations must have basic facilities such as GPS, GIS/Remote Sensing Lab etc.<br>4. The Department Council will make the final decision in the aforementioned matter.<br>5. The Project/Dissertation will emphasize defining the research problem, conducting a comprehensive literature review, collecting relevant data, formulating clear objectives and research questions, developing a robust methodology, analyzing and discussing results, drawing conclusions, preparing a formal report, and ultimately progressing toward a publishable research output. | |