Name of subject	MOTORWAY ENGINEERING (ECTS 10)
Subject/module code	**AMM12310**
Science taught semester (s).	2nd and 3rd semesters
Responsible teacher	Ganiyev Inomjon Gulomovich – head of the department "Road engineering", PhD, professor
Education language	Uzbek
Connection to the curriculum	Compulsory
Training hours (this including independent education)	**Total hours – 300 hours** **Contact hours – 90 hours** Lecture training hours – 45 hours Practical training hours – 45 hours **Independent education – 210 hours**
ECTS	10
Course work	No
The purpose and tasks of subject / learning outcomes	**The purpose of teaching the subject is** To develop competence for planning, designing, constructing, operating and modernizing motorways as integrated systems using functional, geometric, traffic-operational, safety, pavement, drainage, digital-management, environmental, climate and economic criteria. **The objectives of teaching the subject** are to define motorway functional classification, service objectives, and access control requirements; design alignments, cross-sections, interchanges, and ramps based on traffic demand, freight traffic composition, reliability, and level of service; assess the capacity of weaving sections and bottlenecks; select managed lane, ramp metering, and travel demand management strategies; coordinate pavement, drainage, geotechnical, bridge and tunnel interface, and roadside safety solutions; develop intelligent transport systems (ITS), traffic management center (TMC) arrangements, traffic monitoring and control systems, traveler information services, and traffic incident management systems; plan construction stages and quality management processes, apply BIM for Infrastructure, and produce digital as-built records and asset data; assess climate risks, environmental impacts, life-cycle costs, public–private partnership (PPP) and tolling options, and project risks; and prepare an integrated motorway concept and an operational management plan. **Learning outcomes:** 1. Define motorway functional role, level of access control, project objectives and measurable traffic-operational indicators. 2. Select primary motorway parameters from traffic demand, heavy-vehicle share, reliability, level of service and design speed. 3. Design horizontal/vertical alignment, cross-section, median, shoulders, roadside and sight distances safely and contextually. 4. Calculate interchanges, ramps, weaving, collector-distributor and junction elements using capacity and safety criteria. 5. Perform macro/micro traffic modelling, identify bottlenecks and evaluate managed-lane, ramp-metering and demand-management strategies. 6. Coordinate interfaces among pavement, geotechnics, drainage, bridges/tunnels, utilities and construction stages. 7. Apply road-safety audit, human-factor, roadside-safety, incident-management and work-zone-safety methods. 8. Develop an operational architecture including ITS, surveillance, communications, TMC, traveller information, VMS and real-time control.

	9. Compare alternatives using climate resilience, environmental impact, life-cycle cost, economic efficiency, tolling/PPP and risk criteria. 10. Prepare an integrated motorway concept, technical report and professional presentation using CAD/GIS/BIM and traffic simulation tools.
Course content (topics)	**I. Main Theoretical Part (Lecture Sessions).** Topics: 1. Introduction to motorway engineering 2. Planning and technical-economic justification 3. Design-control factors 4. Horizontal and vertical motorway alignment 5. Cross-section and roadside design 6. Interchange types and systematic selection 7. Ramps, weaving and collector-distributor systems 8. Motorway capacity and quality of service 9. Managed lanes and demand management 10. Ramp management and metering 11. Motorway pavements 12. Geotechnics, hydrology and drainage 13. Interfaces with bridges, tunnels and other structures 14. ITS and connected motorway 15. Traffic incident management, emergency response and evacuation 16. Road traffic safety 17. Environmental and climate resilience 18. Construction organization and digital project delivery 19. Operation and maintenance 20. Economic and institutional management 21. Integrated motorway project and international case studies **II. Instructions and recommendations for organizing laboratory exercises** Laboratory work is not included in the curriculum **III. Practical training instructions and recommendations** The instructor's preparation for a practical session begins with the study of initial documents (such as the curriculum, topic schedule, etc.) and concludes with the development of a detailed lesson plan. The instructor must have a clear understanding of the objectives and tasks of the practical session, as well as the amount of work each student is expected to perform. Methodological guidelines serve as the primary instructional document for instructors in preparing and conducting practical sessions. The purpose of the practical session is to facilitate the comprehension of theoretical material, the acquisition of practical skills, the ability to consciously apply knowledge in academic and professional activities, and the development of critical thinking and confidence in forming personal viewpoints. *Recommended Practical Topics:* 1. Develop corridor project brief, demand forecast and evaluation criteria 2. Develop motorway alignment and 3D cross-section in CAD/GIS 3. Integrated cross-section, roadside, median and drainage solution 4. Design interchange/ramp geometry and calculate weaving capacity 5. Model bottleneck, managed-lane and ramp-metering scenarios 6. Preliminary pavement design and life-cycle cost option selection 7. Road-safety audit and work-zone safety report 8. ITS/TMC concept of operations and BIM/CIM model 9. Defend an integrated motorway project **IV. Independent learning and independent work**

	Independent learning competency helps students to develop self-improvement skills and increase the efficiency of their professional activities. Students perform independent tasks on their mobile devices under the guidance of a teacher, either in traditional or electronic form. Recommended topics for independent work: 1. Comparative review of AASHTO/FHWA/HCM and local motorway parameters 2. Traffic-demand, heavy-vehicle and reliability forecast model 3. GIS development and multi-criteria selection of at least three corridor alternatives 4. Digital alignment, 3D model, cross-section and earthworks 5. Interchange, ramps and weaving alternatives 6. Managed-lane, ramp-metering and bottleneck simulation 7. Pavement and life-cycle cost alternatives 8. Drainage, flood and climate-resilience vulnerability/adaptation plan 9. Independent road-safety audit 10. ITS/TMC and incident-management concept of operations 11. Tolling/PPP, cost-benefit, risk and value-engineering analysis 12. Final integrated motorway project and defense preparation
Exam form	Written
Teaching/learning and examination requirements	Complete mastery of theoretical and methodological concepts and practical knowledge of the discipline, the ability to correctly reflect the results of analysis, independently reason about the processes being studied and carry out tasks in the current, intermediate forms of control and independent work, pass written work on the final control. When drawing up final exam questions, deviations from the content of the discipline program are not allowed. The bank of final exam questions for each discipline is discussed at the meeting and approved by the head of the department. No later than 1 week before the start of the final control, tickets signed by the head of the department, enclosed in an envelope, are sealed by the Dean's office and opened 5 minutes before the start of the exam in the presence of students. Final exam duration is 80 minutes. Answers to final exam questions are recorded in copybooks with the seal of the Dean's office. After completion of the final work, the work is immediately encrypted by a representative of the Dean's office, and the copybooks are handed over to the commission for verification. From the moment of completion of the final exam, a period of 72 hours is allotted for checking and posting the results on the electronic platform. The teacher who taught the students in this discipline is not involved in the process of conducting the exam and checking the students' answers. Student(s) who are dissatisfied with the final exam results may submit a written or oral appeal within 24 hours of the publication of the final exam results. Complaints submitted after 24 hours from the publication of the final exam results will not be accepted.
Scope of assessment criteria and procedure	CURRENT CONTROL Purpose: Determining and assessing the student's level of knowledge, practical skills, and competencies on course topics. Instructions: The student's activity in daily classes is assessed through the student's mastery of course topics, as well as constructively interpreting and analyzing the educational material, developing module specific skills, acquiring practical skills (in terms of quality and the specified number) and competencies, solving problem situations aimed at applying professional practical skills, working in a team, preparing presentations, etc.

Current control form: Activity in lessons; Preparing educational materials; Working with sources within the subject; Using educational technologies; Working in a team Preparing presentations; Working with projects.

MIDTERM CONTROL

Purpose: Assessing the student's knowledge and practical skills and level of mastery of lecture material after completing the relevant section of the course.

Form and procedure of intermediate control: Midterm examination is held during the semester during the training sessions after the completion of the relevant module of the curriculum of the subject. Midterm examination is held once in written form within the framework of this subject. Midterm examination questions cover all topics of the subject.

INDEPENDENT LEARNING

Purpose: Independent learning is aimed at fully covering the content of this course, expanding the theoretical knowledge acquired, and establishing independent learning activities for students.

Form and procedure of independent education: independent work assignments are completed in the form of an educational project, presentation, case study, problem solving, information search, digest, colloquium, essay, article, abstract, etc. Completed assignments for independent study are placed in the electronic system and checked based on the anti-plagiarism program and evaluated by the subject teacher.

In this case, the uniqueness of the completed assignment should not be less than 60%, otherwise the assignment will not be accepted for assessment. The number of independent work assignments, depending on the nature of the subject, should not be less than 3 for one subject (module). Independent work assignments account for 60% of the points allocated for current and intermediate control.

FINAL CONTROL

Purpose: The final examination is held at the end of the semester to determine the level of mastery of the student's theoretical knowledge and practical skills in the relevant subject. The final examination is held at a specified time according to the examination schedule created by the Registrar's Office on the electronic platform.

Requirements: The student must have passed the current control, intermediate control and independent learning assignments by the deadline for the final control type in the relevant subject. A student who has not passed the current control, intermediate control and independent learning assignments, as well as who has received a score in the range of “0-29,9” for these assignments and control types, is not included in the final control type. Also, a student who has missed 25 percent or more of the classroom hours allocated to a subject without a reason is excluded from this subject and is not included in the final control type and is considered not to have mastered the relevant credits in this subject. A student who has not passed or was not included in the final control type and has received a score in the range of “0-29.9” for this type of control is considered to be an academic debtor.

Final control form: The final examination in this subject will be conducted in written form. If the final examination is conducted in written form, the requirements for assessment must also be reflected.

Criteria for assessing student knowledge

5 grade	100 points		Assessment criteria
5	90-10	Excellent	When a student is considered to be able

				to make independent conclusions and decisions, think creatively, observe independently, apply the knowledge he has gained in practice, understand, know, express, and narrate the essence of the subject, and have an idea about the subject.
	4	70-89,9	Good	When the student is considered to be able to observe independently, apply the knowledge he has gained in practice, understand, know, express, and narrate the essence of the subject, and has an idea about the subject
	3	60-69,9	Satisfactory	When the student is found to be able to apply the knowledge he has gained in practice, understands, knows, can express, and narrate the essence of the subject, and has an idea about the subject.
	2	0-59,9	Unsatisfactory	When it is determined that the student has not mastered the science program, does not understand the essence of the subject, and does not have an idea about the science.

Course assessment criteria and procedure

Assessment type	Total points allocated	Control (task) form	Distribution of points	Qualifying score
Current assessment	30 points	System tasks	20 points (divided by number of tasks)	18 points
		Student activity (in seminars, practical, laboratory classes)	10 points	
Midterm assessment	20 points	Supervision: writing work	10 points	12 points

<table>
<tr><td></td><td>
<table>
<tr><td></td><td></td><td>System tasks</td><td>10 points (divided by number of tasks)</td><td></td></tr>
<tr><td>Final assessment</td><td>50 points</td><td>Written assignment (5 questions)</td><td>50 points (10 points per question)</td><td>30 points</td></tr>
</table>
* Note: 60% of the points allocated for current and intermediate control are allocated to independent work assignments. Independent work assignments are evaluated as system assignments through the electronic platform.
</td></tr>
<tr><td>Recommended Literature</td><td>
1. Ganiyev, I. Avtomagistrallar muhandisligi / I. Ganiyev. — Jizzakh: So‘g‘diyona NMU, 2026. 233 b.
2. Rogers, M. Highway Engineering / M. Rogers, B. Enright. — 4th ed. — Wiley-Blackwell, 2023. — 448 p.
3. Highway Capacity Manual: A Guide for Multimodal Mobility Analysis / Transportation Research Board. — 7th ed. — Washington, DC: The National Academies Press, 2022. — 3 vol. — 1286 p.
4. Austroads. Guide to Road Design. Part 3: Geometric Design. — Ed. 4.0. — Austroads, 2026. — Publication No. AGRD03-26. — ISBN 978-1-923617-38-4.
5. Austroads. Guide to Road Design. Part 4C: Interchanges. — Ed. 2.1. — Austroads, 2023. — Publication No. AGRD04C-23. — ISBN 978-1-922700-88-9.
6. Mannering, F. L. Principles of Highway Engineering and Traffic Analysis / F. L. Mannering, S. S. Washburn. — 7th ed. — Wiley, 2020. — 416 p.
</td></tr>
</table>