NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF COMMERCE, HUMAN SCIENCES AND EDUCATION

DEPARTMENT OF MARKETING, LOGISTICS AND SPORT MANAGEMENT

QUALIFICATION: BACHELOR OF TRANSPORT MANAGEMENT	
QUALIFICATION CODE: 07BTRA	**LEVEL:** 6
COURSE: INTELLIGENT TRANSPORT SYSTEMS	**COURSE CODE:** ITT611S
SESSION: JUNE 2025	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINERS	PROF. SMART DUMBA (PM) MS. MARTHA POLLA (FM) MR. BONNY CHICKEN (DI) MR. THOMAS MWAHENUKANGE (EF)
MODERATOR:	DR HELVI PETRUS

INSTRUCTIONS

1. Answer **ALL** questions from **Sections A and B**, and any **three (3) questions** from **Section C**
2. Number your answers clearly.
3. The number of marks per each question or part question is given in square brackets [ ]. These should guide you in the content of your answers.
4. This is a **Closed Book Examination.** No books or notes may be consulted during the exam.

THIS QUESTION PAPER CONSISTS OF 7 PAGES (Including this front page)

SECTION A:
ANSWER ALL QUESTIONS

Question 1: State whether the following statements are TRUE OR FALSE

1.1 ITS architectures are prescriptive in nature, detailing specific commercial technologies to be used in deployment. [2 marks]

1.2 Security considerations, including data protection and cyber threats, play a crucial role in the development of ITS architectures. [2 marks]

1.3 The institutional layer of ITS architecture is mainly tasked with managing technical communication between vehicles and roadside units [2 marks]

1.4 The longer a vehicle travels using dead reckoning, the more accurate its estimated position becomes. [2 marks]

1.5 Automatic Number Plate Recognition (ANPR) technology may be used to enforce compliance with vehicle registration, licensing, and speed regulations. [2 marks]

1.6 Access to pre-trip information from ATIS can help reduce emissions by enabling smarter route choices and travel decisions. [2 marks]

1.7 The Communication Layer within the ITS framework oversees transport funding policies and stakeholder agreements. [2 marks]

1.8 Lane management strategies in ATMS often utilise dynamic tools such as lane control signals and variable message displays. [2 marks]

1.9 In dense urban environments, signal reflections and obstructions may cause degraded GPS accuracy due to multipath effects. [2 marks]

1.10 All ITS-related standards and guidelines must be adopted as legal requirements by national transport authorities. [2 marks]

Sub Total 20 marks

SECTION B:
ANSWER ALL QUESTIONS

Question 2: Select the correct answer, each correct answer carries 2 marks

2.1 Which ITS architecture layer is responsible for defining governance structures, stakeholder roles, and the coordination of organisational responsibilities across agencies? [2 marks]

A. Functional Layer
B. Governance Layer
C. Strategic Integration Layer
D. Institutional Layer
E. None of the above

2.2 Which sensor detects metallic objects by measuring changes in inductance? [2 marks]

A. Passive Infrared
B. LiDAR
C. Inductive Loop Detector
D. Ultrasonic Sensor
E. All of the above

2.3 Which ITS enforcement tool deployed in Namibia calculates a vehicle's average speed over a defined distance? [2 marks]

A. ANPR integrated with enforcement databases
B. Weigh-in-Motion stations with velocity overlays
C. ASOD camera system
D. Corridor-based radar enforcement
E. None of the above

2.4 What is the primary cross-border integration challenge facing international ITS deployment? [2 marks]

A. Lack of multilingual road signage
B. Inconsistent communication protocols and standards
C. GPS signal degradation at borders
D. Vehicle size restrictions between regions
E. All of the above

2.5 What is the primary role of an Automatic Passenger Counter (APC) in APTS? [2 marks]

A. Logging onboard Wi-Fi usage
B. Counting boarding and alighting passengers in real-time
C. Detecting ticket payment fraud
D. Monitoring fleet fuel efficiency
E. None of the above

2.6 Which of the following is not a direct function of an Advanced Traffic Management System (ATMS)? [2 marks]

A. Incident management
B. Dynamic lane allocation
C. Adaptive signal control
D. Real-time electronic fare deduction
E. All of the above

2.7 Which of the following presents the most critical environmental limitation of LiDAR in ITS deployment? [2 marks]

A. Sensitivity to sun glare
B. Signal degradation in rain or fog
C. Limited range in open highway settings
D. Incompatibility with GPS-based systems
E. None of the above

2.8 What does an ITS interface specification define? [2 marks]

A. Communication medium bandwidth
B. Legal enforcement zones
C. Formats and protocols for device-to-device data interaction
D. Frequency for remote software updates
E. None of the above

2.9 What is the goal of Best Route Analysis (BRA) in Advanced Traveller Information Systems (ATIS) [2 marks]

A. Selecting cost-effective fleet upgrades
B. Identifying optimal routing based on dynamic traffic conditions
C. Determining preferred toll rates
D. Scheduling public transport vehicle maintenance
E. None of the above

2.10 In dense city centres, what commonly causes GPS position errors known as multipath effects? [2 marks]

A. Overloaded satellite signals
B. Reflections of signals off buildings and large structures
C. Poor satellite calibration
D. Unstable vehicle-mounted antennae
E. All of the above

Sub Total 20 marks

SECTION C:
ANSWER ANY THREE (3) QUESTIONS, EACH QUESTION CARRIES 20 MARKS

Question 3

In a serious weather-related incident, a bridge on the Windhoek-Rehoboth B1 highway, located approximately 30 km south of the capital, suffered structural damage due to heavy rainfall. The Roads Authority issued a public alert urging motorists to exercise extreme caution while approaching the affected area. Images shared show a large crack across the bridge surface, temporarily halting traffic and prompting an emergency response. Officials are assessing the extent of the damage, while temporary diversions and safety measures have been introduced. The event has highlighted the vulnerability of road infrastructure to climate-related events and the urgent need for smart, real-time transport monitoring systems in Namibia.

Using the above case study, discuss how Intelligent Transport Systems (ITS) can be applied to prevent and manage similar incidents in the future. [20 marks]

Question 4

Intelligent Transport Systems (ITS) rely on the integration of three core components to enhance transport system efficiency and safety.

Discuss these components and explain how each contributes to the effective functioning of ITS. [20 marks]

Question 5

In July 2024, the Road Fund Administration (RFA) of Namibia renewed its proposal to implement targeted tolling system on selected national roads to ensure sustainable funding for road infrastructure development and maintenance.

As part of the strategy, the RFA is exploring the integration of Intelligent Transport Systems (ITS) such as Electronic Toll Collection (ETC), Automatic Number Plate Recognition (ANPR), and GPS-based tolling, with the possibility of introducing dynamic congestion pricing based on vehicle type, road section, and time-of-day demand.

This development has sparked national debate. While some view ITS-enabled tolling as a progressive move toward road sustainability and traffic management, others express concern about social equity, affordability, and digital readiness.

Critically evaluate the feasibility of introducing an ITS-based dynamic tolling system in Namibia. [20 marks]

Question 6

I. Define the concept of "data privacy" in the context of ITS. [5 marks]

II. Briefly explain two ethical concerns associated with the collection and use of transport-related data. [5 marks]

III. Discuss the role of policy and regulation in addressing data privacy and ethical challenges in transport technology systems. [10 marks]

Question 7

i. Define Integrated Vehicle Health Monitoring System (IVHMS) and discuss its key functions in supporting efficient fleet management. [10 marks]

ii. Discuss the advantages and disadvantages of implementing Integrated Vehicle Health Monitoring System (IVHMS) in commercial or public transport fleets. [10 marks]

Sub Total 60 marks

TOTAL 100 MARKS
END OF QUESTION PAPER