Bachelor of Technology

B Tech Computer Science Engineering

(Artificial Intelligence and Machine Learning)

National Institute of Electronics and Information Technology
(An Autonomous Scientific Society of Ministry of Electronics and Information Technology, Government of India)
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B.Tech. in Computer Science and Engineering
Artificial Intelligence and Machine Learning (AI & ML)

National Institute of Electronics and Information Technology

Introduction

As the dawn of a new era approaches, the landscape shivers with anticipation – an era where silicon pulses with consciousness and steel moves with purpose: the era of Artificial Intelligence (AI). From precise robotic surgeons wielding scalpels to intuitive assistants anticipating needs before they're voiced, AI has transcended futuristic imagination, seamlessly integrating into our daily existence. It has reshaped industries, redefined human-machine interactions, and poised itself to transform how we perceive the world. This moment marks a pivotal juncture, where you stand on the brink, ready to embark on the forefront of this transformative wave.

The B Tech program in Artificial Intelligence at NIELIT serves as your gateway to becoming a trailblazer in this dynamic field. Developed meticulously by industry experts and academic luminaries, our curriculum transcends conventional education, fostering a profound grasp of AI's fundamental principles. It doesn't just arm you with tools; it empowers you to unlock AI's limitless potential. Through rigorous study, you'll delve into the mathematical foundations of machine learning, where equations cease to be symbols and instead reveal the inner workings of intelligent systems as they learn and evolve from data. You'll become proficient in supervised learning, mastering regression and classification algorithms like an artist molds clay, enabling you to predict and automate with precision. Unsupervised learning will serve as your lens, uncovering hidden patterns within vast datasets, akin to a detective unraveling mysteries in a web of clues. Yet, this journey extends beyond algorithms and equations, delving into the ethical dimensions of AI development. You'll learn to navigate the complex terrain of research methodology and intellectual property rights, ensuring that your contributions to this transformative technology are both responsible and impactful.

Program Education Objectives (PEO)

PEO1: To enable students with a thorough grasp of the mathematical underpinnings, machine learning methodologies, and optimization approaches. This equips them to proficiently apply this knowledge in tackling intricate real-world problems.

PEO2: To cultivate a research-centric mindset and stimulate innovation within the realm of machine learning. Graduates will be empowered to conduct independent research, contribute to the evolution of machine learning techniques, and devise innovative solutions for emerging challenges.

PEO3: To focuses on fostering ethical conduct, promoting awareness of intellectual

property rights, and nurturing holistic development. Graduates will possess excellent communication skills, a keen awareness of societal implications, and a steadfast commitment to values such as sustainability, social responsibility, and perpetual growth.

Program Outcomes (PO)

PO1: Graduates embrace a culture of lifelong learning, adapting to the evolving landscape of machine learning trends, technologies, and methodologies to ensure sustained professional growth.

PO2: Graduates make innovative contributions to the field of machine learning, applying advanced algorithms and artificial intelligence techniques, demonstrating prowess in research, and fostering technological progress.

PO3: Graduates uphold the highest ethical standards, valuing intellectual property rights, considering societal impacts, and responsibly contributing to social, environmental, and ethical considerations.

PO4: Graduates demonstrate their ability to independently tackle intricate challenges in machine learning, showcasing their research acumen and proposing viable solutions effectively.

PO5: Graduates display adept oral and written communication skills, enabling them to articulate technical concepts proficiently and collaborate seamlessly within multidisciplinary teams.

Course Structure

Semester I						
3-Week Orientation Programme						
S. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	HS101	Communication Skills	2	0	2	3
2.	BS102	Mathematics-I	3	1	0	4
3.	BS101	Physics	3	0	2	4
4.	ES103	Mathematical Concepts for AI	3	1	0	4
5.	BS202	Chemistry	3	0	2	4
6.	ES101	Problem Solving and Programming	3	0	2	4
Total Credits : 23						

Semester II						
S. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	BS201	Mathematics-II	3	1	0	4
2.	PC202	Object Oriented Programming	3	0	2	4
3.	PC203	Data Structures	3	0	2	4
4.	PC204	Discrete Mathematical Structures	3	1	0	4
5.	PC205	Modern Computer Architecture	3	0	0	3
6.	HS102	Design Thinking	0	0	2	1
7.	HSMC(H-102)	Universal Human Values-II: Understanding Harmony And Ethical Human Conduct	2	1	0	3
Total Credits : 23						

Semester III						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	PC301	Algorithm Analysis and Design	3	0	2	4
2.	PC302	Database Systems	3	0	2	4
3.	PC303	Computer Networks	3	0	2	4
4.	PC304	Introduction to Machine Learning	3	0	2	4
5.	PC305	Artificial Intelligence	3	1	0	4
6.	OE301	Open Elective-I	3	0	0	3
Total Credits: 23						
Any one course from following options can be opted under "Open Elective-I' (Refer, Appendix –I) 1. Internet of Thing (IoT) -(OE001) 2. Robotics- (OE002)						

Semester IV						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	PC401	Theory of Computation	3	1	0	4
2.	PC402	Software Engineering	3	0	2	4
3.	PC403	Deep Learning	3	0	2	4
4.	PC404	Operating System	3	0	1	4
5.	HS401	Theory of computation Ecosystems	3	0	0	3
6.	EEC401	Minor Project	3	0	0	3
7.	AU202^	Environmental Science	3	0	0	0
Total Credits : 22						

Note: ^ Represents "Audit Course"

Semester V						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	PC501	Data and Visual analytics in AI	3	0	2	4
2.	PC503	Natural Language Processing	3	0	2	4
3.	PC504	Advanced Machine Learning	3	0	2	4
4.	PC502	Optimization Techniques in Machine Leaning	3	1	0	4
5.	EEC501	Minor Project	--	--	--	3
6.	AU301^	Indian Constitution	3	0	0	0
Total Credits : 19						

Semester VI						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	EEC601	Industry / Research Lab Internship	--	--	--	16
Internship option			**Alternate option**			
• Within India or Abroad (MITACS/DAAD/ Any other aligned with GOI schemes) • To enhance hands-on skills (As per NEP-2020) • Refer Appendix-IV for some suggested Internships.			• Alternatively, Courses can also be offered from Open Electives/Professional Electives • Two Course of 3 credits each and one Major project for 10 credits. • Students may opt for a virtual internship along with courses.			

Semester VII						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	PC701	Soft Computing	3	0	2	4
2.	PE701	Professional Elective-I	3	0	2	4
3.	PE702	Professional Elective-II	3	0	2	4
4.	OE701	Open Elective-II	3	0	0	3
5.	EEC701	Capstone Project (Part-I)	----	----	----	6
Total						21
Any one course from following options can be opted under "Open Elective-II' (Refer, Appendix –I) 1. Machine Learning with Python-(OE003) 2. AI for Everyone- (OE004)						

Semester VIII						
S.No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	PE801	Professional Elective-III	3	0	2	4
2.	PE802	Professional Elective-IV	3	0	2	4
3.	EEC801	Capstone Project (Part-II)	-	-	-	10
Total						18

- ***Main emphasis should be on Project Based Learning / Experiential Learning.***
- ***There should be an option to delay internship semester to 7th/8th Semester as per institute convenience and availability of internship slots for different group of students.***

Job Roles

In the fields of Artificial Intelligence (AI) and Data Science, there are numerous job roles catering to various skill sets and expertise levels. Some of the common job roles in these fields:

- Data Scientist
- Machine Learning Engineer
- AI Research Scientist
- AI Engineer
- Data Engineer
- Business Intelligence (BI) Analyst
- Big Data Engineer
- Deep Learning Engineer
- Computer Vision Engineer
- NLP Engineer/Developer
- Conversational AI Developer
- Language Model Researcher
- Machine Translation Specialist
- Text Mining Specialist
- Speech Recognition Engineer
- Sentiment Analysis Specialist

Top Recruiters

The recruitment landscape in the fields of artificial intelligence (AI) and data science is dynamic and diverse, with numerous companies actively hiring talent in these domains. While it's challenging to definitively list the "top" recruiters, several companies consistently seek AI and data science professionals and have established themselves as prominent players in the industry. Some of the notable ones are:

- Google
- Microsoft
- Amazon
- Apple
- Facebook (Meta Platforms)
- IBM
- Netflix
- Tesla
- Uber
- Airbnb, etc
- Tata Consultancy Services (TCS)
- Infosys
- Wipro
- Accenture
- IBM India
- Amazon India
- Microsoft India
- Reliance Jio
- Paytm, etc

Kellton	Persistent Systems	Saksoft
Tata Elxsi	Bosch	Zensar Technologies
Haptik	Lily AI	Oracle Financial Services ...
Cyient Ltd	Happiest Minds Technolo...	Infosys
Gradient AI	Maruti Techlabs Private Li...	Affle (India) Limited
DataToBiz	Fx is Ai	Fractal Analytics
HCL Technologies	Nvidia	TCS
Tech Mahindra	Webtunix AI	Wipro

Walkthrough of Artificial Intelligence Lab

The Artificial Intelligence(AI) Lab is state of the art lab with all high- end machines and AI development kits. The lab is designed to give students hands-on experience in everyday Artificial Intelligence Applications like Predictive Analysis, Image Detection and Analysis, Natural Language Processing tools and applications.

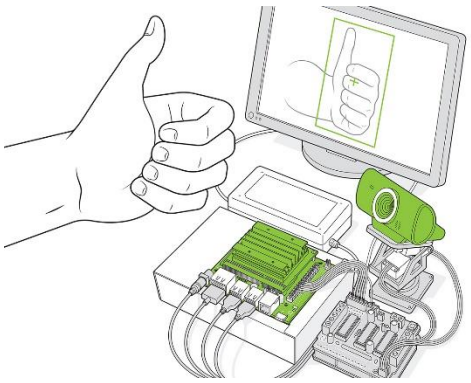
AI lab prepares the students for the future by running various short term skill oriented courses like

- Six weeks in Programming Fundamentals, Data Science, Machine Learning and Deep Learning
- Six months Industrial training in Artificial Intelligence and Machine Learning in collaboration with IIT Ropar.
- Short term workshops in OpenAI, Deep Learning, TensorRT, PyTorch, Artificial Intelligence of Things (AIoT) to boost the interest of students, corporates and professionals in the AI ecosystem.

Our modular design ensures that students learn a variety of skills, stay enthusiastic about learning, and develop their creative interest and also enable research and development of Artificial Intelligent applications.

Students undergo various mini projects throughout the course and develop major live projects in Computer Vision, Natural Language Processing and Predictive Analysis

The Artificial Intelligence Lab has trained more than 1500 participants under short term, long term and other technology awareness workshops in last three years.

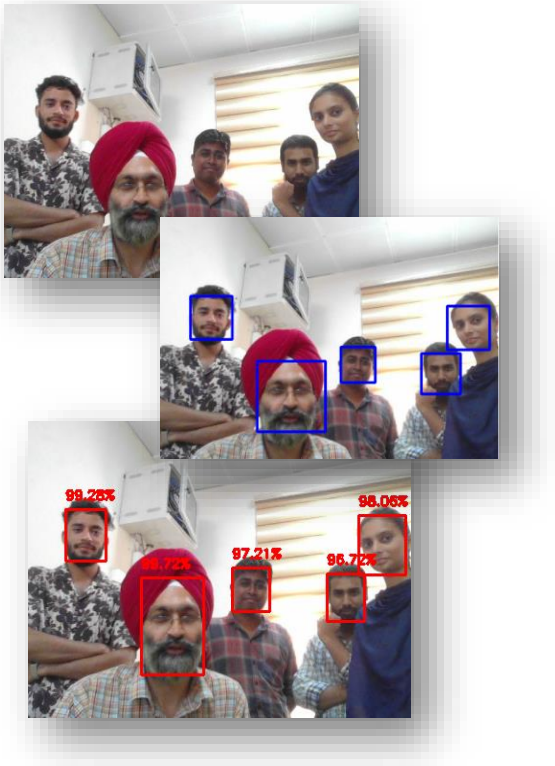


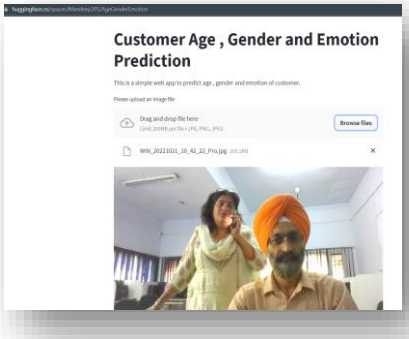
The alumni of Artificial Intelligence Lab have been placed in top notch companies like Nvidia, Quickheal, etc.

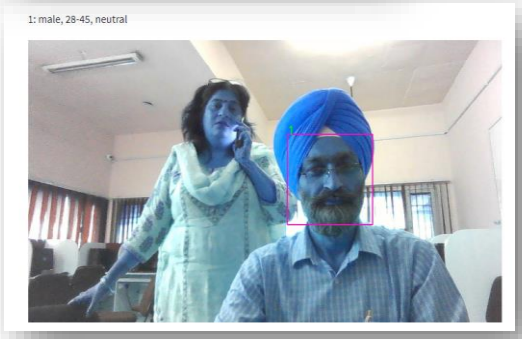
Some of the hardware facilities available in AI lab are :

1	Rack Mounted Sever	HP ProLiant DL160 G8 Server, 2 Intel Xeon E5-2670 v2 CPUs, 128GB DDR3, 2TB SSD
2	15 Desktop PCs	Intel i5, 32 GB RAM, NVidia GeForce GTX 1050 TI Intel (R) UHD graphics 630 (Dell)Graphics Card
3	30 Desktop PCs	Intel i7, 32 GB, Graphics Card
4	5 Laptops	Intel i5, 16 GB RAM, 512 SSD windows 10 professional
5	Jetson Nano kits	Quad-core ARM Cortex-A57 MPCore processor ; Memory, 4 GB 64-bit LPDDR4, 1600MHz 25.6 GB/s ; Storage, 16 GB eMMC 5.1, camera

Projects in the areas of Predictive Machine Learning, Computer Vision, NLP







sThe Artificial Intelligence at NIELIT looks to work in various aspects of AI ecosystem and focus on various verticals. Some of the future endeavors are as under :

Seeking Sponsored Projects and Industrial Collaborations: The lab actively pursues sponsored projects funded by government bodies such as the Govt. of India. Additionally, it seeks partnerships with industrial entities to conduct collaborative research projects in the expansive field of Artificial Intelligence (AI). By combining resources and expertise, these collaborations aim to drive innovation and address pressing challenges in AI research and application.

Establishment of Advanced GPU Computing Facility: A key initiative on the lab's agenda is the establishment of an advanced GPU computing facility. This facility will be instrumental in facilitating cutting-edge research across various domains of AI. With enhanced computational capabilities, researchers will be empowered to tackle complex AI problems more efficiently, leading to breakthroughs in areas such as machine learning, computer vision, and natural language processing.

Conducting Workshops and Training Sessions: In line with the goal of nurturing a skilled workforce in AI, the lab organizes workshops and training sessions. These initiatives serve to disseminate knowledge, share best practices, and equip participants with the requisite skills and expertise in AI technologies. By fostering a culture of continuous learning and professional development, the lab contributes to building a talent pool capable of driving AI innovation in India and beyond.

Emphasis on Societal Impact Projects: Looking ahead, the lab prioritizes AI projects with a focus on societal impact. These projects aim to address pressing societal challenges by leveraging AI technologies to provide innovative solutions. By exploring

new approaches to AI problems and emphasizing real-world applicability, the lab endeavors to make meaningful contributions to areas such as healthcare, education, environmental sustainability, and social welfare.

These future aspects underscore the lab's commitment to advancing AI research, fostering collaborations, empowering talent, and leveraging AI for positive societal change. By aligning its efforts with these strategic priorities, the lab aims to position itself as a catalyst for transformative innovation in the field of Artificial Intelligence.

Fees of the Course and Number of Seats

Fee-Structure for the Academic year (2024-25)

S. No.	Particulars	Sem 1	Sem 2	Sem3	Sem 4
1	Tuition and Lab Fees	65,000/-	65,000/-	65,000/-	65,000/-
2	Caution Money	6,500/-	Nil	Nil	Nil
	Sub Total	71,500/-	65,000/-	65,000/-	65,000/-

Number of Seats: **18**

Eligibility Criteria:

Mode 1: (Based on JEE Main- 2024 score)

Eligibility Criteria:

The candidate

- has passed 10+2 or equivalent examination with at least 60% marks (55% for SC/ST candidates) in aggregate of three subjects, namely, Physics, Mathematics and any one subject out of Chemistry, Biology, Biotechnology and Technical Vocational subject .
- has appeared in JEE Main – 2024
- possesses a good moral character
- is a citizen of India.
- has passed 10+2 examination in 2022, 2023 or appearing in 2024.

The admission shall be made on the basis of JEE Main – 2024 score.
4.1.2. Mode 2: (Based on 10+2 marks in PCM)
Eligibility Criteria:

The candidate

- has passed 10+2 or equivalent examination with at least 70% marks (65% for SC/ST candidates) in aggregate of three subjects, namely, Physics, Mathematics and any one subject out of Chemistry, Biology, Biotechnology and Technical Vocational subject*
- possesses a good moral character.
- is a citizen of India.

- has passed 10+2 examination in 2022, 2023 or appearing in 2024.

The admission shall be made on the basis of percentage of marks in 10+2 with PCM as compulsory subjects.

Reservation Policy

1. Seats are reserved as per Govt. of India Rules, AICTE and/or University Approval.
2. A quota of 15 % is reserved for the SC candidates, 7.5% for ST candidates, 27% for Other Backward Classes and 10% for Economic Weaker Section (EWS):
3. Candidates selected against the quota for persons with disabilities (5%) as per PWD Act 1995 are placed in the appropriate category viz.SC/ST/OBC/General candidates depending upon the category to which they belong in the roster meant for reservation of SCs/STs/OBCs.

Hostel Facilities

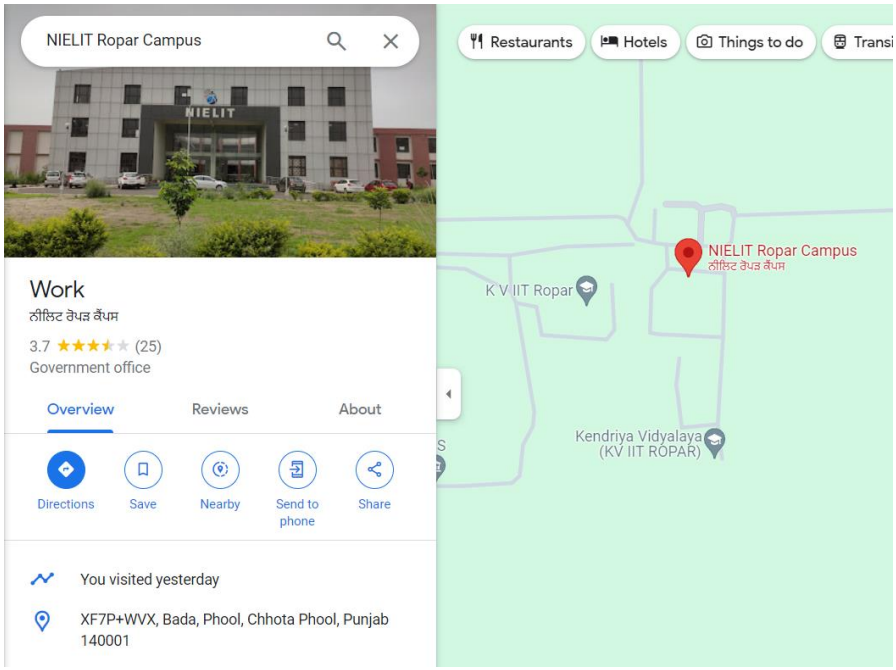
NIELIT Ropar provides in-campus hostel accommodation for both boys and girls separately with a total capacity of 160 seats in each hostel, with modern amenities. The hostels are secured by round-the-clock security guards at the entry gates.

Other Facilities

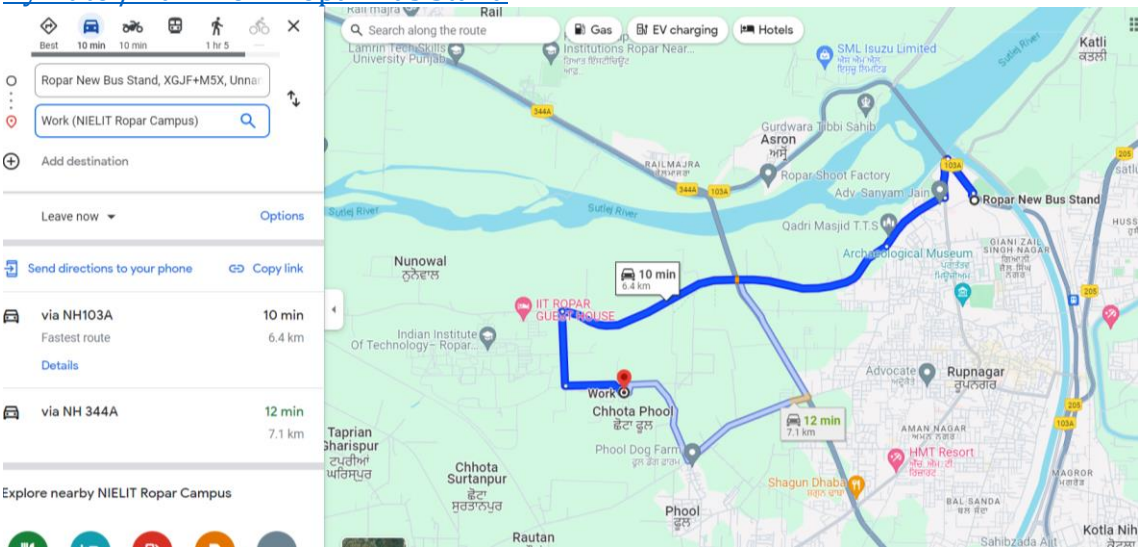
- NKN Connectivity
- 24x 7 Wi-Fi Campus
- IEEE Online Access
- Shodh Ganga Access
- ACM Online Access

Our Location and How to reach to us?

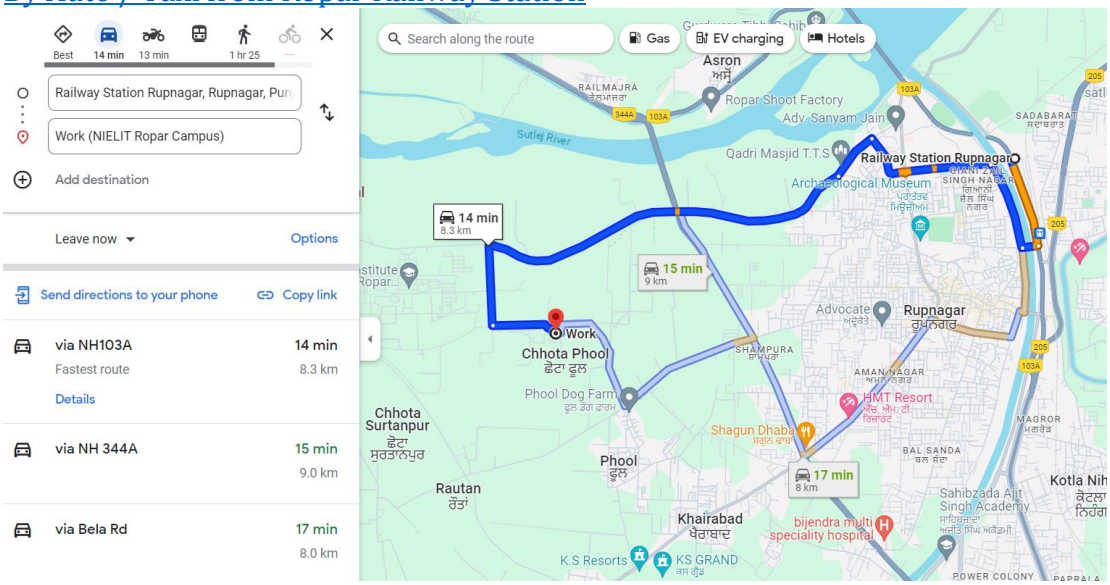
Scan or click to Locate Campus
https://maps.app.goo.gl/LbkUPxSHMBWtEvru5



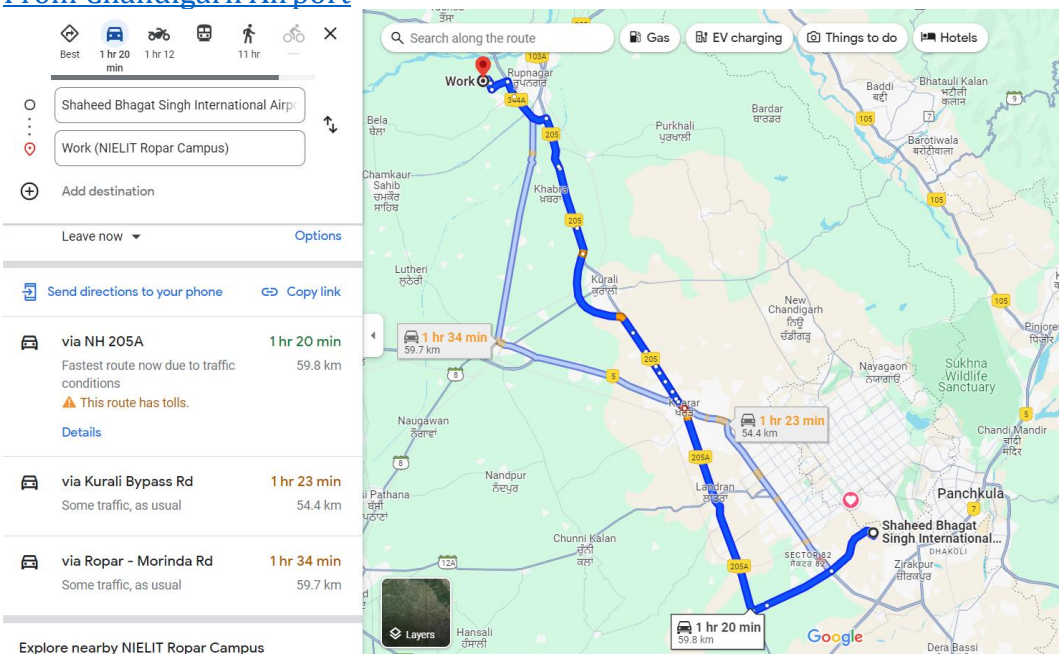
By Auto / Taxi from Ropar Bus Stand



By Auto / Taxi from Ropar Railway Station



From Chandigarh Airport



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