
ADVANCED
MANUFACTURING
INNOVATION
CENTRE
MANUFACTURING
INNOVATION
FOR REAL
WORLD IMPACT
DIGITAL
FACTORY
QUEEN'S
UNIVERSITY
BELFAST
BELFAST
REGION
CITY DEAL

QUEEN'S UNIVERSITY BELFAST

ADVANCED MANUFACTURING INNOVATION CENTRE

Graeme Ralph

Head of Digital Factory

- MSc Advanced Manufacturing – Technology and Systems from Strathclyde University
- 20+ Years in high value manufacturing;
  - Spirit Aerosystems manufacturing engineering and processes development on Airbus A320 Wing, A380 Wing, A350 Wing and Fuse and Boeing 787 Wing
  - Implementation of automated welding and discrete event simulation at BAE Govan & Scotstoun
  - Owner of digitization, automation and advanced assembly development work at Spirit including various ATI projects and Wing of Tomorrow Fixed leading edge rate 100 program
  - Spirit distinctive capability leader and tech board representative at AMRC and AFRC

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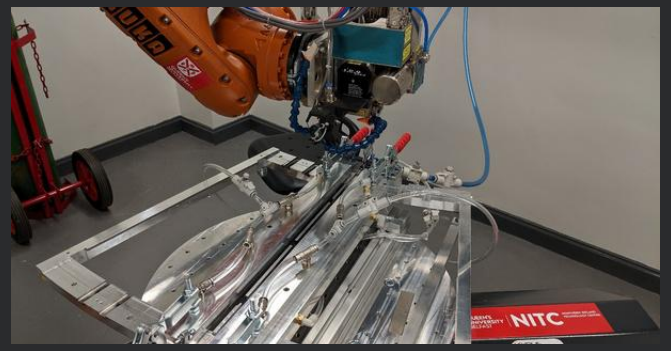
DIGITAL FACTORY

Machining

Ind Metrology & NDI

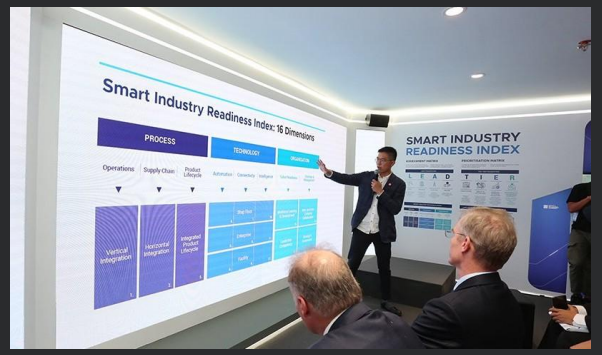
Automation



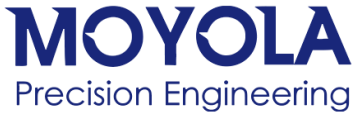
Digital Manufacturing

Digitalisation

Digital Transformation



Examples of AMIC Digital Factor Project Partners & TSG Members



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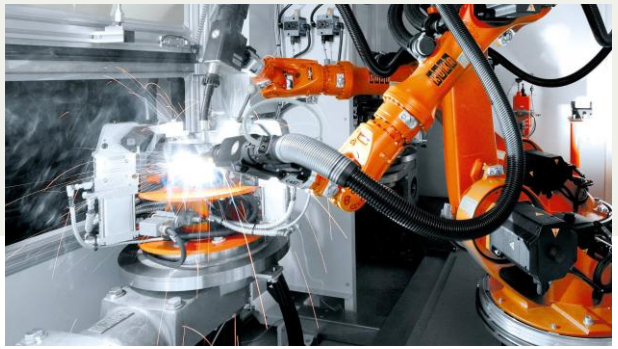
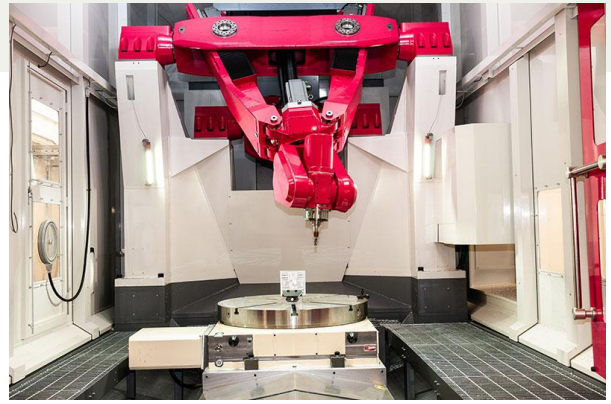
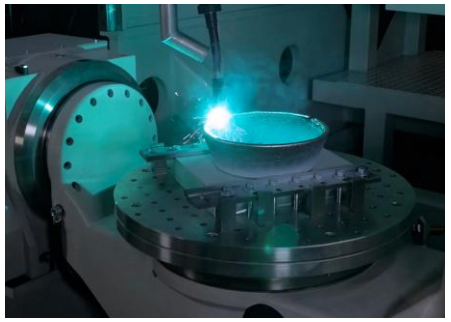
Digital Factory

Advanced Manufacturing Processes and Systems





- Automated Welding
- Automated Drilling and Fastening
- Aerospace Stack Drilling
- Automation Platforms for Aerospace Manufacturing Processes (Stationary/Mobile)
- Advanced Machining for High Rate
- Laser Manufacturing (Cutting/Welding Robotics)
- Advanced Machining (Data and Analytics)
- Flexible Non-Intrusive Industrial Metrology (Scanners, Photogrammetry)
- High Accuracy Inspection (CMM, Laser Tracker)
- Non-Destructive Inspection
- WAAM Additive Tooling
- Novel Platforms – Flexible, Agile, Sustainable Manufacturing Processes (PKM)
- Double Sided Machining
- Flexible/Reconfigurable Manufacturing Systems
- Automated Assembly Inspection
- Automated Robotic Sealing



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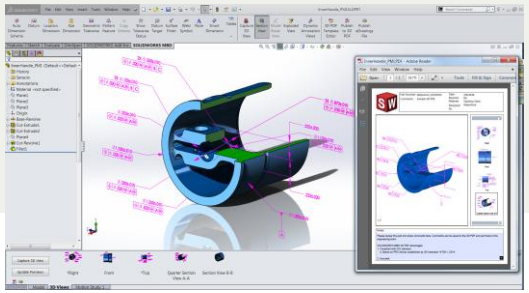
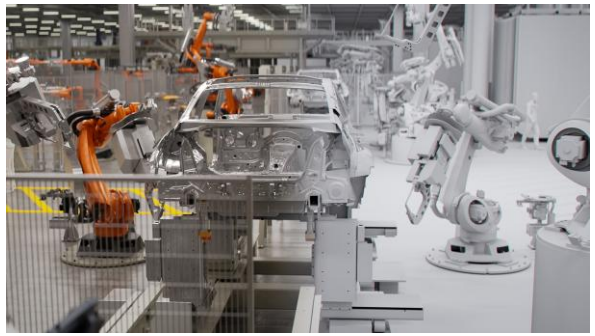
Digital Factory

Connectivity and Digital Technologies



- Advanced Visualisation
- Design Driven Reconfiguration
- AI and ML
- Offline Programming and Simulation
- Factory Design and Discrete Event Simulation
- Dynamic Scheduling
- IoT Devices
- Data Capture and Analytics
- Model based and as built definition
- Connected supply chains
- Data driven manufacturing systems
- Advanced data architectures
- Standards driven rapid integration
- Cyber secure supply chains



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CAPABILITY EXAMPLES

Direct application support to more complex multifunctional solutions that also support other AMIC groups in bespoke applications

Machining	Metrology	Automation	Digitalisation	Digital Manufacturing
Optimised Machining Method	Part or Assembly Measurement	Automated Part or Assembly Movement	Dashboarding from IoT Devices and Sensors	Manufacturing System Model for Virtual Commissioning
In process measurement of run out to ensure stable process		Embedded sensing within automation systems to monitor performance and maintenance		Facility Scanning for 3D visulisation
Cutting tools comparison trials	Improvement in robotic accuracy driven by corrective measurement system feedback and machine learning		Data driven DES model utilising OT devices to capture production cycle data	
Robotic assisted machining process to reduce setup times and minimise distortion, processes and product validated through the machining processes		Data from supply chain enabling scenario planning within a live manufacturing system that can be interrogated with a natural language interface (IS95)		
Coolant level and type testing on specific application	Simulation driven modification to manufacturing flow due to automated measurement identifying non-conformance, planned rework and line balancing plan generated to minimise impact			
Automated machine tending and part measurement and verification producing product passport details linked to part number				Smart scheduling and dynamic planning

Data driven manufacturing system utilizing design model-based definition, as built measurement data from parts and fabrications to enable flexible automation systems that react to variation driven by schedule, design change or any planned or unplanned impact. No faults forward validated by low-cost measurement with full traceability captured in product passport

Digital Transformation

DIGITAL FACTORY

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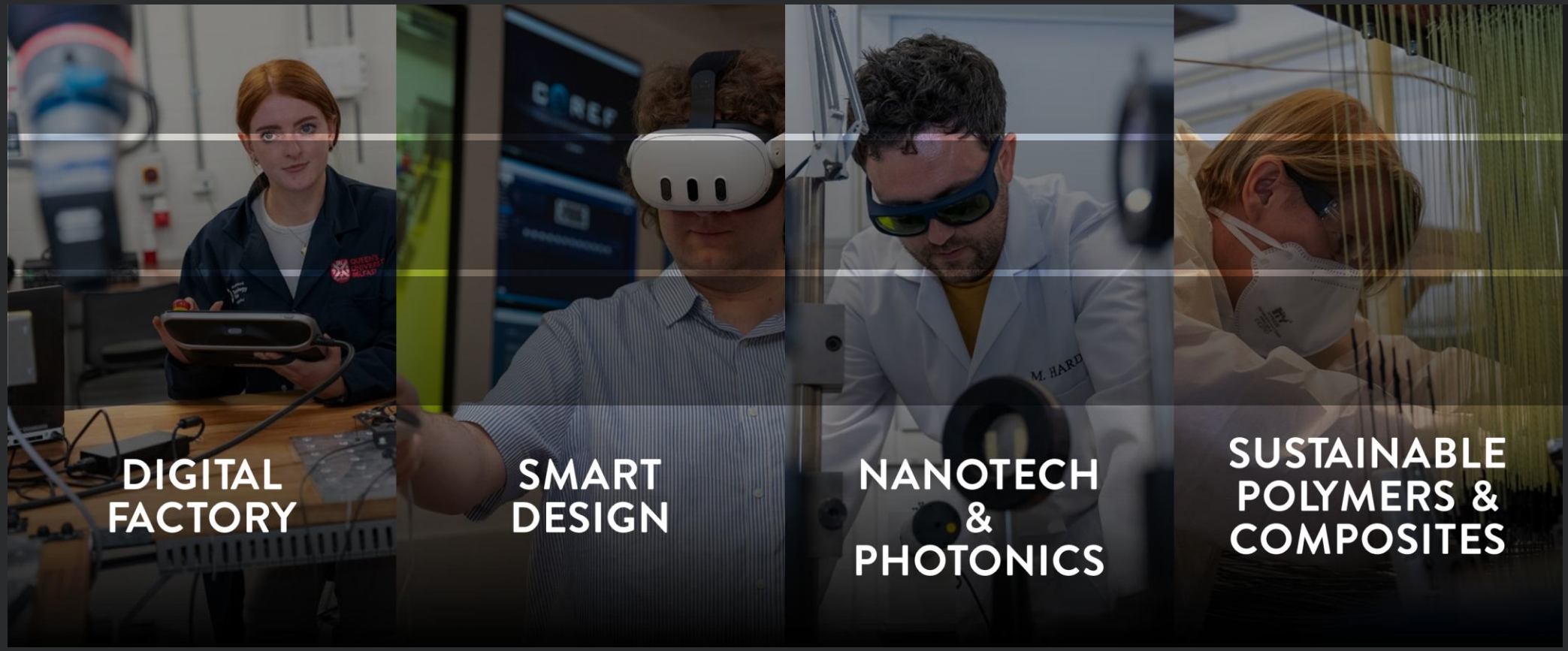
AMIC GROUP COLLABRATION



Skills

Sustainability

Supply Chain

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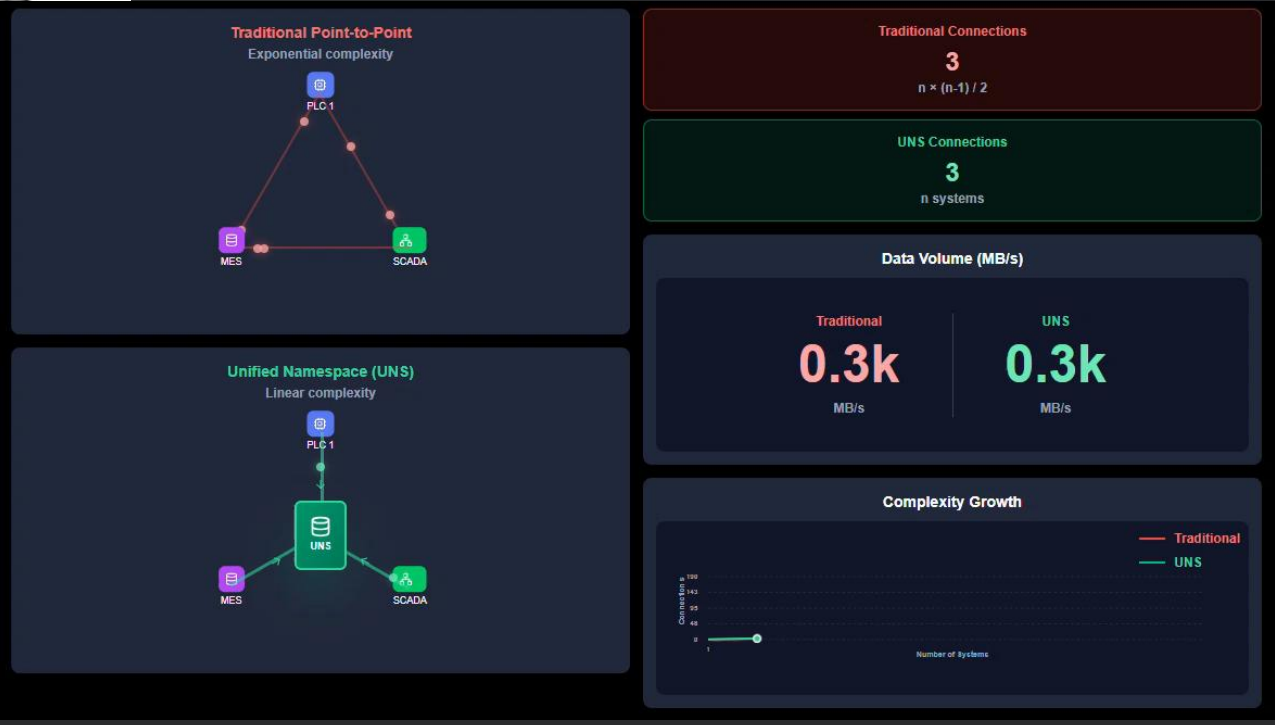
LEGACY EQUIPMENT

DIGITAL FACTORY

UNS

COMMUNITY OF PRACTICE

AMRC Sheffield · AMIC Belfast



Equipment and Capability

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Machining

Multi-Axis Machining of a range of metallics, Flexible machining platforms to enable distortion and cycle time reduction, Robotic support machining platforms, Advanced measurement of machining performance to enable optimisation of subtractive processes.

Automation

High accuracy flexible robotic and automated systems for a range of applications such as assembly, welding, assisted inspection, machining support, sealant application etc. for both high rate, complicated and high mix products.

Industrial Metrology

The measurement and validation of geometric, material properties and validation of performance of parts, components, assemblies and products using advanced contact and non-contact methods along with the use of the data generated.

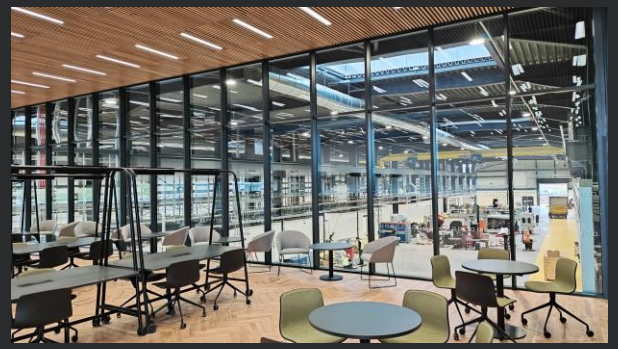
Digital Manufacturing

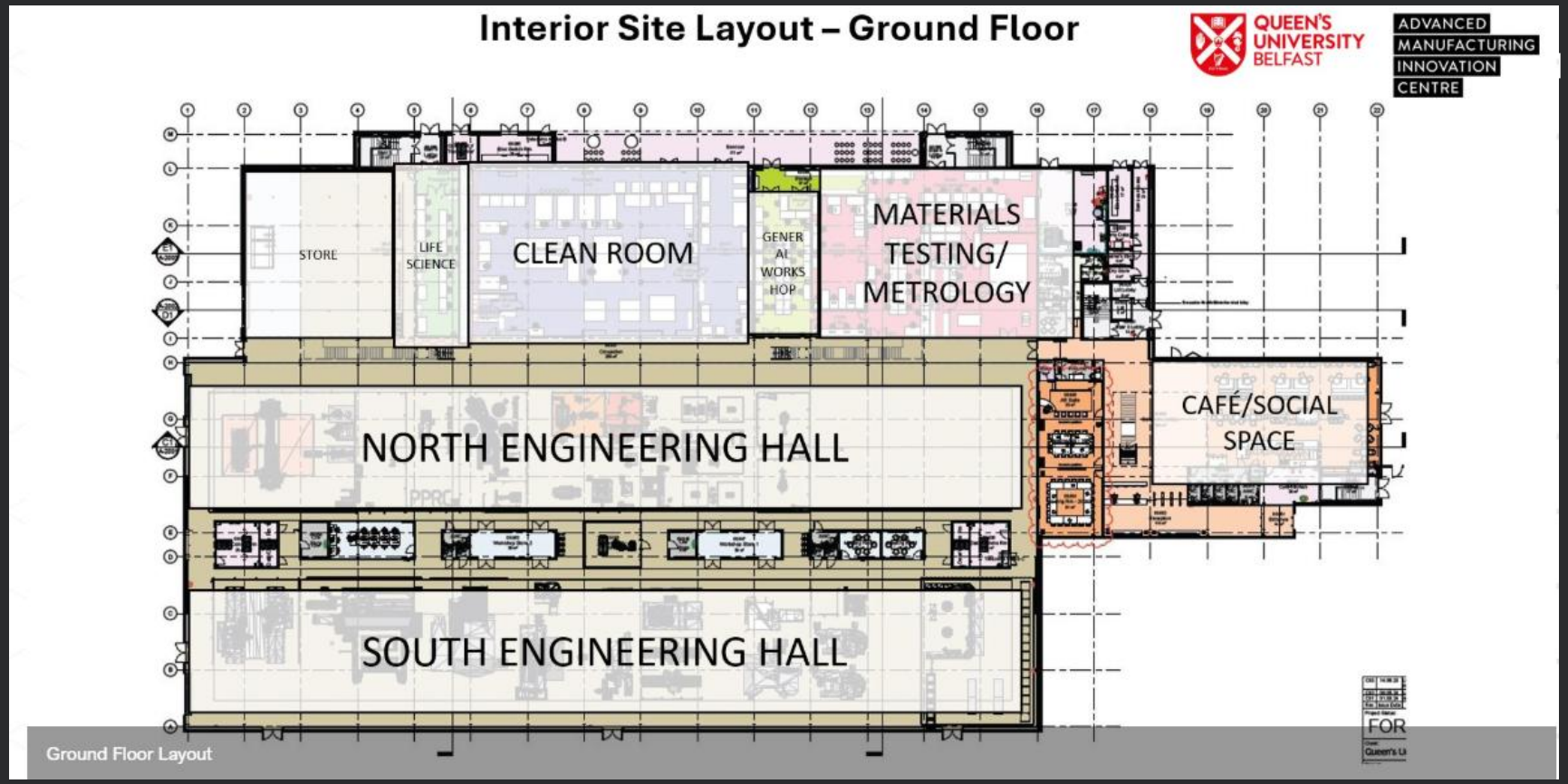
Development of offline and connected validation and visualisation of manufacturing processes and systems through the use and development of advanced software, analytics and methodologies.

Digitisation

Enabling manufacturing technologies, design driven flexibility and business process understanding through connectivity, advanced data architectures, closed loop systems and cyber secure supply chains

FoF




Interior Site Layout – Ground Floor
QUEEN'S UNIVERSITY BELFAST
ADVANCED MANUFACTURING INNOVATION CENTRE
STORE
LIFE SCIENCE
CLEAN ROOM
GENERAL WORKSHOP
MATERIALS TESTING/ METROLOGY
CAFÉ/SOCIAL SPACE
NORTH ENGINEERING HALL
SOUTH ENGINEERING HALL
Ground Floor Layout