



Ministry of Higher Education  
Higher Institute of Engineering and  
Technology, Beheira

# Scientific Research Plan

2023/ 2028

**Table 1. Research Topics in Computer Engineering**

Specialty	Subspecialty	Research Topics
<b>Computer Engineering</b>	Computer architecture and Microprocessors	<ul style="list-style-type: none"> <li>• Computer Architecture</li> <li>• Instruction-Level Parallelism</li> <li>• On-Chip Interconnects</li> <li>• Processor Micro-architectures</li> </ul>
	Software Engineering and Computer Languages	<ul style="list-style-type: none"> <li>• Service oriented architecture SOA (Systems: Optimization, Reliability and Adaptation)</li> <li>• Agent-oriented software abstractions</li> </ul>
	Computer Networks	<ul style="list-style-type: none"> <li>• Network operations and management</li> <li>• Network flows and Security</li> <li>• Routing algorithms</li> <li>• Network standards and protocols</li> <li>• Next Generation Internet and Related Technologies</li> <li>• Network simulation and emulation</li> <li>• Network coding</li> </ul>
	Machine Intelligence, Artificial Intelligence, and Robotics	<ul style="list-style-type: none"> <li>• Agent Technology (software and hardware intelligent agents – architecture, planning and learning for single and multiple agents).</li> <li>• Computational Intelligence (different applications that require:               <ol style="list-style-type: none"> <li>a. Solving multi-objective problems using Evolutionary computation and real world applications.</li> <li>b. Genetics-based machine learning</li> <li>c. Self- Search techniques (hyper-heuristics, adaptive and self-adaptive parameter control, adaptive operator selection, automated construction of search heuristics)</li> <li>d. Neural Networks</li> <li>e. Bayesian Networks</li> <li>f. Avatars</li> </ol> </li> </ul>
	Computer Vision, Image Processing, and Remote Sensing	<ul style="list-style-type: none"> <li>• Arabic sign language recognition</li> <li>• Scene Understanding</li> </ul>
	Computer Systems Security and Data Encryption	<ul style="list-style-type: none"> <li>• Encryption</li> <li>• Network Security</li> <li>• Authentication mechanisms</li> <li>• IP protection</li> <li>• Hardware Security Units</li> </ul>
	Database Systems and	<ul style="list-style-type: none"> <li>• Distributed Databases</li> </ul>

	Information Technology	<ul style="list-style-type: none"> <li>• Database Security</li> </ul>
	Automation of Computer Systems and Circuit Design	<ul style="list-style-type: none"> <li>• Design for manufacturing and design for yield tools.</li> <li>• Formal verification tools</li> </ul>
	Parallel and Distributed Computers and Systems	<ul style="list-style-type: none"> <li>• Parallel and Distributed Architectures</li> <li>• Parallel and Distributed Models</li> <li>• Interconnection Networks</li> <li>• Cloud Computing</li> <li>• Specification and Design</li> </ul>
	Computer Operation and Manufacturing	<ul style="list-style-type: none"> <li>• Multi-core architecture and supporting compilers and operating systems</li> <li>• Testing, Validation and Verification of Hardware Design</li> </ul>
	Operating Systems and Algorithms	<ul style="list-style-type: none"> <li>• Multi-Core Operating Systems Kernels</li> <li>• Distributed storage systems</li> <li>• Randomized algorithms</li> </ul>

**Table 2. Research Topics in Architecture Engineering**

Specialty	Subspecialty	Research Topics
<b>Architecture Engineering</b>	History & Theory of Architecture	<ul style="list-style-type: none"> <li>• Universal design to promote tourism.</li> <li>• Nostalgia in contemporary architecture.</li> <li>• Recreation uses as a design determinant for shopping malls.</li> <li>• Egyptomania in modern architectural history.</li> <li>• Tire ancient Egyptian character in contemporary' architecture.</li> <li>• Popular movement in contemporary' architecture.</li> <li>• Facades as a tool to analysis urban developing.</li> <li>• Crisis in architecture history.</li> </ul>
	Building Technology	<ul style="list-style-type: none"> <li>• Nano materials for improving the efficiency of public buildings.</li> <li>• Smart architecture in sustainable public buildings.</li> <li>• Contemporary building materials in sustainable smart buildings.</li> <li>• BIM in construction management.</li> <li>• Recycled construction and demolition waste to achieve sustainability.</li> </ul>
	Environmental Architecture	<ul style="list-style-type: none"> <li>• Analysis of LEED and GPRS in public buildings.</li> <li>• Legislations in sustainable buildings.</li> <li>• Design determinants of BIPV system in housing.</li> <li>• Using photovoltaic cells in public buildings.</li> <li>• Passive design and ecological systems in architecture.</li> <li>• Biophilic design in green buildings.</li> <li>• Eco-technological and ecological design.</li> <li>• Indoor ventilation to achieve a healthy environment.</li> <li>• Assessment of sustainability of residential complexes.</li> <li>• Sustainable built environment in administrative Buildings.</li> <li>• Building envelopes to support sustainability.</li> <li>• Efficiency of hospitals through sustainable perspective.</li> <li>• Modern applications to achieve sustainability.</li> <li>• Applying smart architecture in university's buildings.</li> </ul>
	Conservation of Historic Buildings and Areas	<ul style="list-style-type: none"> <li>• Traditional crafts to achieve the sustainable development.</li> <li>• Adaptive reuse of heritage buildings and historic zones.</li> <li>• Urban heritage integration.</li> <li>• Authenticity of heritage sites.</li> <li>• Urban heritage conservation.</li> <li>• Conserving urban archaeology.</li> <li>• Managing Urban Heritage and Complex Systems.</li> <li>• Re-thinking Authenticity, Integrity, and Values.</li> <li>• Re-clustering historic zones through the creative economy.</li> </ul>

		<ul style="list-style-type: none"> <li>• The Traditional architecture of the heritage villages. Developing and upgrading of nature preserves.</li> <li>• Management of nature preserves.</li> <li>• Systemic and Governance Challenges.</li> <li>• The Credibility of the World Heritage List.</li> <li>• Historic characters in transportation systems.</li> <li>• Heritage and cultural resources as a support for the tourism and travel industry.</li> <li>• Sustainable Development and Community-Centered Approaches.</li> <li>• Green areas in historic buildings.</li> <li>• BIM in heritage management.</li> <li>• Advanced Digital Technologies and Data Management.</li> </ul>
	Urban Design & Landscape	<ul style="list-style-type: none"> <li>• Bring nature back to the city.</li> <li>• Design vibrant public spaces.</li> <li>• Public spaces during and after the pandemic.</li> <li>• Green Urbanism and Landscape.</li> <li>• Urban health in cities.</li> <li>•</li> </ul>
	Urban Planning	<ul style="list-style-type: none"> <li>• Sustainability to upgrade the quality of life.</li> <li>• International support programs in urban planning and management.</li> <li>• Solid waste management in healthy cities.</li> <li>• Air pollution on prices of real estate.</li> <li>• Challenges and opportunities in implementing cities.</li> <li>• City Management.</li> <li>• Industrial fourth revolution in sustainable cities.</li> <li>• Reliability of citizen science in plan formulation.</li> <li>• Harnessing value-based financing for achieving SDGs.</li> <li>• Relationship between rural and urban in sustainable development.</li> <li>• Public participation in rural communities.</li> <li>• Intangible culture of city.</li> <li>• Tragedy of the urban commons.</li> <li>• Hermeneutic phenomenology for spatial analysis.</li> <li>• Smart and livable metropolis.</li> <li>• Land uses and cover on transportation.</li> <li>• Socially sustainable in smart cities.</li> <li>• Open spaces for women’s needs.</li> <li>• Reality in Egyptian cities through their urban competitiveness.</li> <li>• Global urban competitiveness to improve cities sustainability.</li> <li>• Global events in urban communities’ development.</li> <li>• Egyptian cities performance through urban indicators.</li> </ul>

		<ul style="list-style-type: none"> <li>• Happiness index and its role in supporting the cities branding.</li> <li>• Embedding SDGs in architectural and planning education.</li> <li>• Urban spaces as a factor of healthy environment.</li> <li>• Tourism as a factor of sustainable development.</li> <li>• Marginal urban spaces in cities.</li> </ul>
	Regional Planning	<ul style="list-style-type: none"> <li>• Urban metabolism as a tool for urban management.</li> <li>• Urban development and climate change phenomenon.</li> <li>• Environment and sustainability in Arabic countries.</li> <li>• Enhancing the nations' branding globally in middle east region.</li> <li>• Cities brand strength indexes.</li> <li>• Countries competitiveness to increase national income.</li> </ul>
	Housing	<ul style="list-style-type: none"> <li>• Affordable accessible housing.</li> <li>• Adapting existing and future housing design after pandemic.</li> <li>• Housing policies in the developing countries.</li> <li>• Sustainable urban neighborhoods.</li> </ul>

**Table 3. Research Topics in Civil Engineering (Structural Eng.)**

Specialty	Subspecialty	Research Topics
<b>Structural Engineering</b>	Reinforced Concrete	<ul style="list-style-type: none"> <li>• Studying the behavior of reinforced concrete members under static and dynamic loads.</li> <li>• Investigating the behavior of structures when using special concrete such as High strength concrete, Fiber reinforced concrete, and Self compact concrete.</li> <li>• Studying the behavior of reinforced concrete members reinforced with new materials and methods.</li> <li>• Studying the effect of openings on different members such as slabs and beams in different structural systems.</li> <li>• Investigating the behavior of deep beams with openings under different boundary conditions.</li> <li>• Repair and strengthening of reinforced concrete members with the new advanced materials and techniques.</li> <li>• Repair and strengthening of reinforced concrete members such as slabs and columns exposed to Fire.</li> <li>• Behavior of different types of reinforced concrete shells.</li> <li>• Developing the finite element programs with different techniques to analyze the different reinforced concrete members and structures to study the effects of nonlinear behavior.</li> <li>• Comparisons between design concepts of reinforced concrete structures due to different international codes of practice.</li> <li>• Effects of wind and earthquakes on different systems of high-rise buildings.</li> <li>• Effects of Shear Walls Dimensions and Locations for Resisting Wind and Earthquake Loads by different codes.</li> <li>• Effects of earthquake forces on cylindrical tanks.</li> <li>• Using Innovative materials and construction methods in reinforced concrete structures.</li> </ul>
	Steel Structures	<ul style="list-style-type: none"> <li>• Behavior of offshore jacket structures.</li> <li>• Aerodynamic behavior of double-deck cable-stayed bridges.</li> <li>• Non-linear analysis of double-glazed units resting on elastic supports.</li> <li>• Non-linear dynamic behavior of composite structures.</li> <li>• Dynamic analysis of cabled steel bridges under construction.</li> <li>• The application of mathematical tools such as neural networks in the design of structures.</li> <li>• Behavior of space structures under blast loads.</li> <li>• Various applications of Concrete-Filled-Steel- Tube (CFST) in recent structures.</li> <li>• Behavior of composite and non-composite under blast and fire loads.</li> <li>• Recent Trends in the Design and behavior of light-weight structures.</li> </ul>

**Table 3.1 – continued. Research Topics in Civil Eng. (Structural Eng.)**

Specialty	Subspecialty	Research Topics
Structural Engineering	Soil Mechanics and Foundations	<ul style="list-style-type: none"> <li>• Finite element analysis of raft or slab-on-ground foundation constructed over expansive soils.</li> <li>• Water movement in terms of soil suction in unsaturated expansive soil.</li> <li>• Prediction of volume changes (shrink/heave) in expansive soil.</li> <li>• Measurement of soil suction for unsaturated expansive soils.</li> <li>• Improving the behavior of problematic Soil.</li> <li>• Finite element analysis of laterally loaded piles.</li> <li>• Soil-structure interaction and subgrade models.</li> <li>• Analysis of vertically loaded pile groups in multilayered soil.</li> <li>• Analysis of laterally loaded pile groups.</li> <li>• Soil stabilization techniques.</li> <li>• Specific research in geosynthetics and reinforced soil retaining structures problems.</li> <li>• Deformation behavior of base materials under different conditions.</li> <li>• Effect of rock anisotropy on the behavior and strength of limestone rock.</li> <li>• Bearing capacity equations for rocks.</li> <li>• Dewatering techniques.</li> <li>• Analysis of piled raft foundation.</li> <li>• Analysis of composite piled raft foundation.</li> <li>• Bio- based soil improvement.</li> <li>• Analysis of the Soil Deformation Caused by Tunneling.</li> <li>• Analysis of soil movement induced by deep excavation.</li> <li>• Analysis of Mechanically Stabilized Retaining Walls.</li> <li>• Settlement performance of shallow foundations rested on reinforced soil.</li> <li>• Behavior of shallow foundations rested on reinforced soil</li> </ul>
	Project Management	<ul style="list-style-type: none"> <li>• Planning and Scheduling.</li> <li>• Resource Allocation.</li> <li>• Repetitive Projects.</li> <li>• Risk Analysis.</li> <li>• Construction Legislations and contracts.</li> <li>• Integrated Management.</li> <li>• Construction Economic.</li> </ul>

Table 3. – *continued.* Research Topics in Civil Eng. (Structural Eng.)

Specialty	Subspecialty	Research Topics
<b>Structural Engineering</b>	Properties and testing of materials	<ul style="list-style-type: none"> <li>• Phase changing materials in concrete manufacturing,</li> <li>• Nano materials in cementitious composites,</li> <li>• Green construction using geopolymer composites,</li> <li>• Recycled materials in nonstructural elements,</li> <li>• GFRP application in ferrocement elements,</li> <li>• Grout mortars in structural applications,</li> <li>• Acrylic paints for water insolation purposes.</li> <li>• Self-Curing concrete.</li> <li>• Self-curing self-compacting concrete.</li> <li>• Green concrete.</li> <li>• Applications of Pervious concrete.</li> <li>• Recycled aggregate concrete.</li> <li>• Ultra-high strength concrete and reactive powder concrete.</li> <li>• Repair and strengthening of reinforced concrete elements.</li> <li>• Repair and strengthening of timber elements.</li> <li>• Green blocks.</li> <li>• Performance of self-compacted concrete</li> <li>• Lighting concrete</li> <li>• Properties of cementitious composites,</li> <li>• Reactive powder concrete</li> <li>• Nanotechnology in repair and protection.</li> <li>• Applications and durability of RPC</li> <li>• Application of RPC &amp;UHSC</li> <li>• Repair &amp;strength with nano materials</li> <li>• Durability of concrete with nanomaterials</li> <li>• Durability and Application of concrete with marble powder</li> <li>• Self-healing Concrete</li> <li>• Self-Cleaning concrete</li> <li>• Eco Friendly Concrete technology</li> <li>• Green Building materials</li> <li>• Recycling waste materials reduces Carbon emissions in Concrete construction.</li> <li>• High strength light weight concrete</li> <li>• Improving lightweight concrete properties using nano materials</li> <li>• Durability of light weight concrete</li> <li>• Design lightweight concrete according to different codes.</li> <li>• Producing nano materials using low-cost materials.</li> <li>• Fibrous concrete.</li> <li>• Control and quality assurance for fresh and hardened concrete.</li> <li>• Repair and strengthening of walls.</li> <li>• Repair and strengthening of Heritage buildings.</li> <li>• Effect of using admixtures on fresh and hardened concrete properties.</li> </ul>

**Table 3. - continued. Research Topics in Civil Eng. (Structural Eng.)**

Specialty	Subspecialty	Research Topics
<b>Structural Engineering</b>	Analysis and Mechanics of Structures	<ul style="list-style-type: none"> <li>• Behavior of laminated glass plates.</li> <li>• Modal analysis, damage detection and health monitoring of structures.</li> <li>• The structural performance of structures and their components under different kinds of loads: dynamic loads, cyclic loads, static loads.</li> <li>• Behavior of structures and their components strengthened and repaired with the traditional strengthening method or with the new advanced materials under different kind of loads.</li> <li>• Optimization of structures.</li> <li>• The application of mathematical tools in the analysis of structures.</li> <li>• Soil-structure interactions.</li> </ul>

**Table 3. Research Topics in Civil Engineering (Public Works)**

Specialty	Subspecialty	Research Topics
<b>Public Works Engineering</b>	Sanitary Engineering	<ul style="list-style-type: none"> <li>• Various Conventional Treatment Processes (water, sewage) investigating their design, applications, performance, modeling, and efficiency enhancement.</li> <li>• Sea and brackish water desalination</li> <li>• Water distribution networks modeling and optimizing their related components (storage tanks, valves and accessories, surge protection, etc.)</li> <li>• Wastewater collection and conveyance systems including gravity sewers, pump stations, force mains, directional drilling, and tunnelling.</li> <li>• Treated effluent reuse aspects (process selection, reuse impact; ..)</li> <li>• Municipal wastewater sludge management (e.g., digestion, composting, stabilization, etc.)</li> <li>• Multi-disciplinary research with other specialties concerning the above and other related topics.</li> </ul>
	Environmental Engineering	<ul style="list-style-type: none"> <li>• Industrial wastewater management (minimization, treatment, recycling, etc.)</li> <li>• Environmental impacts of industrial and other (residential, commercial, tourism, etc.) activities.</li> <li>• Innovative treatment technologies (e.g., electro-coagulation, membrane application, phenton oxidation, etc.) covering physical, chemical and biological applications.</li> <li>• Municipal solid waste management (including intermediate and final steps)</li> <li>• Multi-disciplinary research with other specialties related to environmental engineering field.</li> </ul>
	Highway and Airport Engineering	<ul style="list-style-type: none"> <li>• Sustainability in highways construction &amp; maintenance.</li> <li>• Evaluation for pavement rehabilitation techniques especially full depth reclamation (FDR).</li> <li>• Environmental impact of recycled materials in asphalt mixtures.</li> <li>• Pavement reinforced with Geosynthetics materials.</li> <li>• Green pavement and its applications.</li> <li>• Natural fibers and waste materials in hot asphalt mixtures.</li> <li>• Recycled materials in roads construction.</li> <li>• Effect of aggregate characterizations on rigid and flexible pavements performance.</li> <li>• Quality of highways projects management.</li> <li>• Pavement superposition effects multiple aircraft tires.</li> <li>• Analysis of jointed concrete pavement in airports.</li> <li>• Evaluation of Factors Affecting Pavement Performance.</li> <li>• Effect of ageing on the performance of hot asphalt mixtures.</li> <li>• Reliability analysis of flexible and rigid pavement.</li> </ul>

**Table 3. - continued. Research Topics in Civil Engineering (Public Works)**

Specialty	Subspecialty	Research Topics
<b>Public Works Engineering</b>	Traffic and Transportation Engineering	<ul style="list-style-type: none"> <li>• Evaluation of U-Turn design at roadway median openings.</li> <li>• Approaches to achieve sustainability in traffic &amp; transportation engineering.</li> <li>• Applications of Intelligent transportation systems.</li> <li>• Effects of transportation projects on air pollutants &amp; climate change.</li> <li>• Risk and reliability analysis in highway and traffic engineering.</li> <li>• Use of new approaches and methodologies to improve road safety in Egypt.</li> <li>• Characterizing the impact of road humps on real-world vehicle emissions.</li> <li>• A new approach to determine the overall level of service on road sections.</li> <li>• Estimation of trip generation rates for different activities in Egypt.</li> <li>• Modeling Park and ride choice in Egypt.</li> <li>• Speed profile models for Egyptian Roads.</li> </ul>
	Photogrammetric Engineering	<ul style="list-style-type: none"> <li>• Research into the DEM; formats, data sources, creation, accuracy factors and environmental applications.</li> <li>• Creation and analysis of DSM from each of aerial imagery and VHRSI stereo pairs with the use of different image matching algorithms.</li> <li>• Research into Object Recognition from Multispectral Very High-Resolution Satellite Imageries.</li> <li>• Research into Different Airborne Imaging Systems in Feature extraction, object recognition and DEM Generation.</li> <li>• Research into Hyperspectral Imaging Systems in Object Recognition and Mapping of Natural Resources.</li> <li>• Research into full wave-form LiDAR in detection and mapping of water and natural resources.</li> <li>• Research into exploitation of multispectral LiDAR in object recognition, feature extraction and terrain analysis.</li> </ul>
	Geodetic Engineering	<ul style="list-style-type: none"> <li>• The design of the Global Positioning System (GPS) Based on Artificial Intelligent techniques.</li> <li>• Designing of the optimum geodetic networks using genetic algorithms</li> <li>• Use of PSO algorithm in determination of the optimum observation weights in the deformation monitoring networks.</li> <li>• Development of geographic information system integrated with artificial neural networks techniques.</li> <li>• Application of evolutionary algorithms to geodetic networks analysis and design.</li> </ul>

**Table 3. Research Topics in Civil Engineering  
(Irrigation and Hydraulic Engineering)**

Specialty	Subspecialty	Research Topics
<b>Irrigation and Hydraulic Engineering</b>	Irrigation and Drainage Engineering	<ul style="list-style-type: none"> <li>• Conservation of water through canal networks.</li> <li>• Improvement of operational management systems for irrigation canals in the context of integrated water resources management.</li> <li>• The effect of the ripples dimensions on the turbulent co-efficient and wall displacement.</li> <li>• Performance assessment of subsurface drainage system in the Nile delta Egypt.</li> </ul>
	Coastal Engineering	<ul style="list-style-type: none"> <li>• Shorelines change detection.</li> <li>• Protection works for costal shorelines of</li> </ul>
	Irrigation Structures	<ul style="list-style-type: none"> <li>• Health monitoring of hydraulic structures.</li> <li>• Minimizing scours downstream hydraulic structure.</li> <li>• Maintenance of hydraulic structures.</li> <li>• Overtopping breaching of earth dams.</li> </ul>
	Water Resources	<ul style="list-style-type: none"> <li>• Improving water quality of different water resources.</li> <li>• Non-conventional water resources.</li> <li>• Water reuse.</li> <li>• Water resources management in Egypt.</li> </ul>
	Ground Water	<ul style="list-style-type: none"> <li>• Seepage from canals.</li> <li>• Sea water intrusion.</li> <li>• Control of groundwater contamination</li> </ul>
	Hydraulics	<ul style="list-style-type: none"> <li>• Nile navigation problems.</li> <li>• Influence of compound channel geometry on velocity and discharge.</li> <li>• Local scour around skew submarine pipeline.</li> <li>• Flow characteristics through compound transitions open channel.</li> <li>• Hydraulic jump in circular open channel.</li> <li>• Improving the flow characteristics at open channel junctions.</li> <li>• The effect of using gabions on the hydraulic properties at open channels.</li> </ul>
	Hydrology	<ul style="list-style-type: none"> <li>• Flash flood hazards mapping.</li> <li>• GIS and remote sensing in the water sector.</li> <li>• Water harvesting structure suitability</li> </ul>

**Table 4. Research Topics in Basic Sciences**

<b>Specialty</b>	<b>Research Topics</b>
<b>Basic Sciences</b>	<ul style="list-style-type: none"><li>• Materials Science and Engineering</li><li>• Organic Chemistry</li><li>• Energy Science and Engineering (Physics, Chemistry, Materials)</li><li>• Environmental Science and Engineering (Chemistry, Earth Science)</li></ul>