Areas of Specialization

Departments		
Sr. No.	**Academic Units**	**Areas**
1	Aerospace Engineering	Low-speed experimental aerodynamics, Dynamics & Control of aerospace vehicles, Aerospace structures and aerospace propulsion
2	Biosciences and Bioengineering	1. **Medical Instrumentation**: medical imaging in any modality; instrumentation for electrophysiology; diagnostic/monitoring instrumentation; surgical/interventional instrumentation 2. **Medical Signal & Medical Image Processing**: electrophysiological signal processing (Evoked potentials, EEG, EMG, ECG, etc.), in vivo medical image processing 3. **Physiological Systems Modelling**: cardiovascular system modelling; musculoskeletal modelling; respiratory system modelling; systems control perspective to physiological modelling. 4. **Data Science for Biomedical Engineering**: digital health (AI/ML/IoT) applications at the hospital/clinical level **Additionally,** candidates must have a basic degree in engineering or physical sciences (biomedical, electrical, instrumentation, mechanical, computational, systems control; physics, math, statistics), with a research background at the human systems and/or whole organ level having closely worked in the physiological systems/clinical domain and future research plans at the human systems/whole-organ level. Research work at the sub-cellular, cellular, and tissue levels will not be considered.
3	Chemical Engineering	1. Biotechnology and Biosystems Engineering 2. Catalysis and Reaction Engineering 3. Energy and Climate Studies 4. Materials Engineering 5. Process Systems and Controls Engineering 6. Transport, Colloids and Interface Science 7. Other Frontier areas of chemical engineering
4	Chemistry	1. New methods in asymmetric synthesis 2. Solid state Chemistry emphasizing Catalysis, Supersonic Conductors, 2D Materials, Intermetaliics and Semimetals. 3. Organometallics and Catalysis.

5	Civil Engineering	The candidates should have a strong academic and research background with basic Engineering degree in Civil Engineering or allied areas. 1. CE1 (Transportation System Engineering): (1-i) Transportation Planning; (1-ii) Transportation Economics and Finance; (1-iii) Pavement Analysis and Design. 2. CE2 (Geotechnical Engineering): (2-i) Underground Space Utilization; (2-ii) Centrifuge-based Physical Modelling; (2-iii) Environmental Geotechnology; (2-iv) Soft Ground Engineering. 3. CE3 (Water Resources Engineering): (3-i) Fluid Mechanics; (3-ii) Hydraulics; (3-iii) Groundwater Hydrology; (3-iv) Environmental Fluid Mechanics. 4. CE4 (Structural Engineering): (4-i) Structural Performance under Natural and Man-made Hazards; (4-ii) Mechanics of Advanced Materials; 5. (4-iii) Computational Mechanics. 6. CE5 (Ocean Engineering): (5-i) Offshore Engineering; (5-ii) Physical Oceanography. 7. CE6 (Remote Sensing): (6-i) Photogrammetry; (6-ii) LiDAR; (6-iii) Geodesy and Geocomputation. 8. CE7 (Construction Technology and Management): (7-i) Building Physics and Modelling; (7-ii) Automation and Robotics in Construction. The candidates with exceptional credentials may be considered in any areas of Civil Engineering, in addition to the above specific areas.
6	Computer Science & Engineering	Databases (all sub-areas); Compilers and Programming Languages (all sub-areas); Computer systems and networking (all sub-areas); ML/AI: crowdsourcing, robotics, learning theory, multi-agent systems; Computational Biology and Bioinformatics; Computer vision, computer graphics, image processing and other areas of visual computing; Cryptography and Computer security: Systems Security, Hardware Security, Network Security, Security Analysis, Applied Cryptography; Theoretical Computer Science: all sub-areas including computational geometry; Computer Architecture: all sub-areas; Formal Methods and Verification; Software Engineering and software architecture. Exceptional candidates from other areas of Computer Science & Engineering will also be considered.

7	Earth Sciences	1. Isotope Geochronology/Geochemistry 2. Groundwater Hydrogeology 3. Mineral Exploration/Mining Geology 4. Mathematical Geology/Geostatistics 5. Tectonic Geomorphology 6. Quantitative Seismic Interpretation/ Seismic Reservoir Characterization 7. Petrophysics related to petroleum exploration 8. Computational Geophysics / Geophysical modelling 9. Geophysical Signal Processing 10. Gravity and Magnetic Methods **For all positions in Geology (from 1 to 5)** **Essential Qualifications** 1. M.Sc / M.Sc (Tech)/ M.Tech degree in Geology or any allied field related to Geology 2. Ph.D. in the relevant field of Geology. **Desirable** Experience in handling sophisticated instruments, adequate exposure to experimentation, field geology, numerical modelling, computational methods and simulations as applicable in different specialisations. **For all positions related to Geophysics (from 6 to 10)** **Essential Qualifications** 1. M.Sc / M.Sc (Tech)/ M.Tech degree in Geophysics or in any of the fields related to Geophysics 2. Ph.D. in the relevant field of Geophysics. **Desirable** Industrial experience for the fields related to petroleum exploration with experience in quantitative and/or qualitative seismic interpretation. Experience in application of AI and ML techniques to geophysical applications.
9	Economics	Financial Economics, International Trade and Finance, Monetary Economics, and Open Economy Macroeconomics
8	Electrical Engineering	Control Systems and Computational Methods; Power Electronics and Power Systems; 1. **Communication Theory, Systems and Networks**: Millimeter-Wave/Microwave Circuits, Systems & Antennas, Communication Systems Hardware, Optical Communications, and Quantum

		Communication & Cryptography; Multimedia Signal Processing; Machine Learning and Big Data; Analog/Mixed-signal/RF Integrated Circuit and System Design; 2. **Digital System Design, Test and Manufacturing**: System-on Chip, DFM, Computer Architecture & Hardware, and Algorithm-to-Chip Level Design. 3. **Semiconductor Devices and Technology**: Fabrication, Characterization, Packaging, and Reliability; Optoelectronics (Sensors); Quantum Technologies and Applications; Quantum Materials and Devices; Power Semiconductor Devices; Bioelectronic/Biomimetic Devices, Energy Conversion and Storage; Oxide Electronics and MEMS/NEMS. Exceptional candidates from other areas of Electrical Engineering will also be considered.
10	Energy Science and Engineering	**Energy Policy** **Essential Qualifications** 1. Bachelors and Masters Degree in Science (Physical/Chemical/ Mathematical) or Engineering; 2. Ph.D. in area related to Energy Policy with emphasis on energy supply, demand and consumption; energy scenarios modeling; and technology assessment and forecasting. **Desirable** Experience in energy scenarios modeling and technology assessment and forecasting; Publications in journals related to energy policy **Micro-energy harvesting (Piezoelectric, thermoelectric or acoustic application)** **Essential Qualifications** 1. Bachelors and Masters Degree in Science(Physical/Chemical/ Mathematical) or Engineering 2. Ph.D. in areas related to micro-energy harvesting using piezo-electric, thermo-electric, or acoustic applications. **Desirable** Experience in development and analysis of micro-energy harvesting devices.

11	Environmental Science and Engineering	Candidates must possess Ph.D. degree with specialization in Environmental Science / Engineering from reputed Institutes with M.Tech./M.E./M.S., and B.Tech./B.E./B.S. in Environmental/ Civil/ Chemical Engineering, Environmental Management and allied disciplines or M.Sc. degree in Environmental Science/ Environmental Management and allied disciplines. Candidates should have demonstrated research and teaching expertise in one or more of the areas listed: 1. Ecology, Ecosystem Monitoring, Environmental Microbiology 2. Contaminant Transport, Contaminated Site Remediation and Restoration 3. Environmental Systems - Modelling, Informatics, Environmental Impact Assessment, and Risk Assessment
12	Humanities & Social Sciences	1. **Sociology:** Economic Sociology, Anthropology, Labour/Industrial Sociology, Political Sociology. Agrarian, Rural/village studies, Sociology of religion, Digital Sociology, Quantitative Sociology, Sociology of Education, and Public Health. 2. **English**: All areas of Literature and Theoretical linguistics; Theatre, and Performance studies. 3. **Psychology**: Social Psychology, Industrial/ Organizational Psychology, Clinical Psychology, Environmental Psychology, Computational Psychology, Cognitive Psychology, Sport Psychology, Political Psychology 4. **Philosophy**: Logic, Philosophy of Science, and Indian Philosophy 5. **Sanskrit:** Indian Science, and Technology 6. **Political Science**: Political Thought, Comparative Politics, and Indian Politics 7. **History**: Modern, Medieval and Ancient History, and Archaeology
13	Mathematics	Algebra, Analysis, Combinatorics, Geometry, Number Theory, Numerical Analysis, Partial Differential Equations, Probability, Statistics, Theoretical Computer Science and Topology
14	Mechanical Engineering	Bio-fluid mechanics, bio-fluid heat transfer, Refrigeration and Air Conditioning, Particle-laden flows, two phase flow and heat transfer; Manufacturing automation, and intelligent process control, IEOR with special focus on production system, design and controls. Applications of operations research to manufacturing; Dynamical systems and control, biomechanics, experimental solid mechanics with applications to micro-

		electro-mechanical systems, electric vehicles, fuel cells, design of novel materials and failure analysis aided by machine learning.
15	Metallurgical Engineering & Materials Science	Manufacturing (Materials Joining, Additive Manufacturing, Casting, Forming, Surface Engineering), Corrosion Science and Engineering, Physical Metallurgy (steel, aluminium, magnesium, titanium and its alloys, superalloys, shape memory alloys): Preferably Experimental, Glass/Ceramics Process Engineering.
16	Physics	**1. Optics** 1. Experimental/Theoretical BEC/quantum optics 2. Experimental Quantum Optics and Optical quantum technology 3. Experimental: Biophotonics, Optical communication, THz photonics and Ultrafast sciences **2. Experimental Soft Matter Physics and Physics of Biological Systems** 1. Equilibrium and non-Equilibrium physics of complex fluids (colloids, 2. polymers, membranes, liquid crystals and glassy materials) in both 3. biological and inanimate active matter systems. **3. Astrophysics** 1. Gravitational Waves and Multimessenger Astrophysics (Theory/Observations/Instrumentation) **4. Condensed Matter Physics (Expt.)** 1. Magnetic, Superconducting, Spintronic, and Topological systems Materials/Devices/Technology 2. Semiconductors - Growth/Devices/Technology 3. Time-resolved experiments to study different ultrafast processes in materials using pulsed photons in visible, ultraviolet and X-ray frequencies **5. Condensed Matter Physics (Th.)** 1. First principles simulation of nano-scale transport (in areas such as spintronics, photovoltaics etc) 2. Study of correlations and topology in condensed matter systems with emphasis on analytical techniques **6. High Energy Physics (Th.)** 1. Collider physics and physics beyond standard mode 2. Astroparticle Physics 3. Quantum Chromodynamics (QCD)

		4. String Theory and Mathematical Physics **7. High Energy Physics/Nuclear Physics (Exp.)** 1. Low Energy Experimental Nuclear Physics 2. High energy Nuclear/Particle Physics **8. Quantum Information Theory** 1. Quantum Error Correction 2. Fundamental Study of Quantum algorithms

Schools

Sr. No.	Academic Unit	Areas
1	IDC School of Design	Product Design; Communication Design; Animation; Interaction Design; Mobility and Vehicle Design; Bionics and Design; System Thinking; Material Culture; Sketching and Visual Representations; Sustainable Product Design; Illustration/Drawing; Ceramics; VR/AR/New Media; Immersive Technologies; Game Design; Filmmaking; Automotive Styling and Design; Sustainable Transport; Smart Mobility; Connected Mobility; Human Powered Mobility; Mobility for Special Needs
2	Shailesh J. Mehta School of Management	1. General Management: With specialization in any of the following 1. Research Methods 2. Corporate Governance & Business Ethics 3. Legal Aspects of Business 4. Communications & Interpersonal Skills 2. Information Systems 3. Accounting: With Specialization in Financial and Managerial Accounting 4. Organizational Behaviour & HRM 5. Marketing Management 6. Decision Sciences & Quantitative Methods: With specialization in Statistical methods and/or Decision Models in Management. 7. Technology & Strategic Management
3	Desai Sethi School of Entrepreneurship	Technology entrepreneurship, including product innovation, intellectual property management, technology licensing, startup marketing, business modelling, finance for entrepreneurs (including startup financing), startup incubation, business communication, leadership, team building and social entrepreneurship; Key application sectors: agri-tech, bio-tech, edu-tech, fin-tech, med-tech, energy-tech, e-vehicles, environment, smart manufacturing, and other verticals

Centres

Sr. No.	Academic Unit	Areas
1	Centre for Policy Studies	The candidates in areas of Public Policy with particular background in 1. Digital Societies 2. Water/ Sanitation policy 3. Economist with research in interest in Agriculture / Industrial Policy
2	Centre of Studies in Resources Engineering	Earth observation and geospatial technology, and its applications to earth systems studies specifically in the following areas 1.Satellite Image Processing 2. SAR interferometry 3. Photogrammetry, GNSS, GPS, LiDAR, Surveying and Geodesy 4. Agro-informatics and precision agriculture 5. Oceanography, Coastal and Marine studies 6. Atmospheric Studies 7. Natural Hazards and Disaster Management 8. Forestry and Ecology 9. Urban Development and Town Planning, Infrastructure Planning
3	Centre for Technology Alternatives for Rural Areas	Science and Technology applications towards sustainable development using concepts in the following thematic areas: Food processing, Nutrition, and Public Health; Farm Machinery; Technology Development and Dissemination; Development, Technology, and Society; Planning and Development including Basic Services; Monitoring & Evaluation; Natural Resources; Public Policy and Governance.
4	Centre for Urban Science and Engineering	1. Urban ecology 2. Urban economics and financing 3. Urban governance and policy 4. Urban resilience and disaster management 5. Urban design and built environment 6. Building science 7. Urban studies 8. Urban informatics and analytics 9. Urban mobility 10. Urban environmental management (Energy, Water, Air, Waste) 11. Urban and regional planning
5	Koita Centre for Digital Health	Healthcare/Medicine/Bio-engineering/Public Health/Health Policy/ Health Economics driven by digital/information/ communication technologies such as bioinformatics, biostatistics, medical imaging, sensors, AI/ML, IoT, and bio-signal processing.

6	Centre for Machine Intelligence and Data Science	Data Sciences; Machine Learning; Artificial Intelligence; Statistics; Systems and Computational issues in AI/ML/DS; AI/ML/DS in application areas including Finance, Health, Sustainability, Transportation, Mechanics, Sciences, Industry, Robotics and Autonomous Systems; Machine Learning theory; Social choice, Game theory, Multiagent systems; Data and information systems; AI/ML in Text, Speech, and Natural Language Processing; Computer Vision; AI and Society, Policies, Trust, Ethics; Any other significant AI/ML area.

Inter Disciplinary Programmes

Sr. No.	Academic Unit	Areas
1	Interdisciplinary Programme in Education Technology	Development of technology enhanced learning environments for various purposes; Discipline based education research, in engineering, sciences or computing disciplines; Learning sciences and cognition; Learner modeling using educational data analytics; Teacher use of educational technology; Assessment and evaluation; Technology for foundational literacy and numeracy; Social justice research in the context of technology enhanced learning. Experience with using technology tools for building interventions and carrying out research studies is essential.
2	Industrial Engineering and Operations Research	The candidate should have an excellent academic and research background in Industrial Engineering (IE), Operations Research (OR) or allied areas, with a strong quantitative / computational approach in modeling and analysis. Specific areas: 1. Contemporary issues in logistics and supply chains, including network optimisation, resilient supply chains, digital twin & Internet-of-Things, supply chain analytics, sustainable operations, pricing & revenue management, or related areas. 2. Application of IE and OR in areas of health-care operations, financial engineering, smart city, security, or related areas. 3. Simulation, stochastic optimisation, robust optimisation, multi-player/ multi-agent systems, artificial intelligence & machine learning methods, or related areas with demonstrated applications in the areas of IE and OR. Candidates with exceptional credentials in any area of IE and OR, in addition to the above specific areas, may be considered.
3	Systems and Control Engineering Department	1. All core areas of systems and control, autonomous systems, robotics, distributed control, quantum control, learning, and data sciences. 2. All emerging areas resulting from the amalgamation of control and decision sciences with classical and quantum information, inference theory, complex systems, high-dimensional phenomena, networking and security, model approximation, machine learning, communication, signal processing, flexible structures interacting with fluids, and systems biology.
4	Interdisciplinary Programme in Climate Studies	**1. Climate Science** Earth system modelling, Climate extremes, Atmospheric, land and oceanic processes, integrating climate observations-modelling-services; Regional climate: Regional climate modeling, Climate forcing by atmospheric gases and aerosols, Tropical meteorology, Indian monsoon, Seasonal to sub-seasonal (S2S) predictions, Urban

		meteorology, Biometeorology; Biogeochemical cycles: Global carbon, water, nitrogen, phosphorus and sulphur cycles, Paleoclimate **2. Climate Impacts and Adaptation** Climate and Health, Agricultural Impacts, Hydrological Impacts, impacts on cryosphere, Assessment of Vulnerability, Climate Risk Assessment, Impacts on Ecosystem, Designing adaptation in different sectors, Climate resilience. **3. Climate Mitigation and Policy** Climate Mitigation, Climate Policy, Sustainability, Climate Equity and Negotiations, Climate Finance and Market, Human settlement & spatial planning.