***Annexure -1***

# IIT Madras - Special Drive for SC/ST/OBC-NCL on Mission Mode

## Specialization Areas

**Advt.No.IITM/R/1/2025 Dt 01.01.2025**

Department-wise specific qualification requirement (if any), and areas of specialization sought are detailed in the table below. Candidates must clearly demonstrate their capability in the specialization area(s).

| SNo | Department | Specific Qualification Requirement | Specialization Area |
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| 1 | **Aerospace Engineering** | Candidates must clearly demonstrate their capability in the specialization area applied for through publications in relevant reputed journals and have aero background as detailed below:<br>At least one degree (Bachelor's / Master's / Ph.D.) in Aerospace (Aero.) Engineering.<br>(OR)<br>At least 3 years teaching experience in handling undergraduate / graduate level courses related to Aerodynamics / Flight Mechanics / Aerospace Propulsion / Aerospace Structures in an Aero. Engineering department at an IIT / IIST Trivandrum / reputed university abroad.<br>(OR)<br>Ph.D. thesis relevant to Aero. Engineering and awarded by a university without an Aero. Engineering department. | (i) Airplane Design<br>(ii) Airplane Aerodynamics<br>(iii) Experimental structural mechanics<br>(iv) Structural Dynamics (experimental background preferred)<br>(v) Advanced Manufacturing of Aerospace Structures.<br>(vi) Avionics & sensors for aerospace applications (with hardware background)<br>(vii) Air Traffic Management. |
| 2 | **Applied Mechanics and Biomedical Engineering** | (a) At least one pre-PhD engineering degree (at the bachelor's or master's level)<br>(b) Post-doc research experience preferred | Specialization Area* |
| | *The department specializes in interdisciplinary research that spans the fields of solid mechanics, fluid mechanics, biological/bioinspired systems and biomedical engineering. Applications are invited from candidates with strong engineering acumen and an interdisciplinary focus in addressing contemporary critical challenges that fits into at least one of the following specializations:<br>(i) **Mechanics of Energy Materials** with a focus on contemporary multiphysics challenges, such as but not limited to caloric materials, mechanical degradation of battery materials, solid rocket propellants, structural integrity in nuclear applications.<br>(ii) **Stochastic Mechanics in Materials** with expertise in investigating uncertainty, randomness, and probabilistic characterization of mechanical behaviour.<br>(iii) **Dynamics of Systems** focussing on nonlinear, multiscale, emergent behavior and resilience in large ordered systems.<br>(iv) **Data Science for Medical Informatics:** Advancing the fields of healthcare and medical informatics using cutting edge approaches of data science.<br>(v) **Diagnostics & Therapeutic technologies:** Design and development of affordable, scalable, and available medical devices for medical diagnostics and therapeutics. | | |

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| | (vi) **Prosthetics and Implants:** Designing, optimizing and developing next-generation prosthetics, implants, and biohybrid systems.<br>(vii) **Immersive Technologies (AR & VR) for biomedical applications:** Leveraging the potential for experiential technologies (virtual reality, augmented reality and mixed reality) for medical training, surgical planning, rehabilitation, and therapeutic interventions.<br>(viii) **Emerging areas in Biomedical Engineering:** Other areas that have exceptional potential for the development of cutting edge technologies in the broad field of Biomedical Engineering and which are complementary to the existing expertise available in the department. | | |
| 3 | **Biotechnology** | a) Ph.D. in Biological Sciences with a minimum of three years postdoctoral experience in at least one of the cancer biology research areas specified. | ***(i) Experimental cancer biology***<br>*The prospective applicant is expected to establish a research group focused on addressing fundamental questions in understanding of the molecular genetic mechanisms of cancer initiation, progression, metastasis and tumour-immune cell cross-talk. Expertise in using animal models and/or human primary cancer tissue samples to address these questions, evidenced by peer-reviewed publications, is essential. In addition, the candidate must have demonstrated expertise with cutting-edge high-throughput technologies such as gene editing, genomics, proteomics, and metabolomics.*<br>*Ability to complement the existing strengths in the department is desirable.* |
| | | b) BE / BTech in Chemical Engineering (preferably) / Biochemical Engineering / Biotechnology / Materials Science and Engineering / Equivalent and a Ph.D. and post-doctoral experience in any of the relevant domains. | ***(ii) Biomaterials Engineering***<br>*The prospective applicant must demonstrate their domain expertise in designing biomaterials in at least one of the following areas, supported by peer-reviewed publications and/or granted patents.*<br>*2.1) Biomaterials for Immunotherapy / immunoengineering (or) Gene therapy & RNA-based therapeutics (or) High throughput single-molecule sensing (or) Omics-based technologies*<br>*2.2) Computational design of biomaterials* |
| | | c) BE / BTech in Chemical Engineering (preferably) / Biochemical Engineering / Biotechnology / equivalent and a Ph.D. and post-doctoral experience in any of the relevant domains. | ***(iii) Synthetic biology for green manufacturing/Downstream processing for recombinant therapeutics***<br>*The prospective applicant must demonstrate experimental expertise in at least one of the following specializations; relevant industry experience would also be valued*<br>*3.1) Synthetic biology/Metabolic engineering and Bioprocess development for green manufacturing of industrial metabolites*<br>*3.2) Cell-line engineering/Downstream processing for recombinant therapeutics* |

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| 4 | **Chemistry** | Candidates must have their basic degrees, B.Sc. and M. Sc. (or M.S. as applicable) with chemistry as the major subject of study and a Ph.D. degree in the field of chemistry. | All the areas of Chemistry |
| 5 | **Civil Engineering** | Basic degree in Civil Engineering*<br>PhD specialization in any of the specified areas.<br><br>* Exceptional candidates with basic degree in allied areas will be considered in the following areas: Construction Materials / Infrastructure and Construction Management / Environmental Engineering / Transportation Engineering. | (i) Construction Materials<br>(ii) Infrastructure and Construction Management<br>(iii) Environmental Engineering<br>(iv) Hydraulics and Water Resources Engineering<br>(v) Geotechnical Engineering<br>(vi) Structural Engineering<br>(vii) Transportation Engineering |
| 6 | **Computer Science & Engineering** | Specific Qualification***** | All areas of Computer Science and Engineering |
| | Specific Qualification*****<br>● **Bachelor's Degree**: Candidates must have an engineering degree in Computer Science / Computer Science and Engineering/ Computer Engineering.<br>● **Master's Degree**: Candidates must hold a master's degree in engineering from Computer Science / Computer Science and Engineering/ Computer Engineering program. [This may be waived if the candidate was admitted to a direct Ph.D. program after the Bachelor's degree.]<br>● **Ph.D. Degree**: Must be in Computer Science/ Computer Science and Engineering/ Computer Engineering.<br>Applications of candidates with deviations from the above qualification areas may be considered if they have an exceptionally good record of publications in areas related to Computer Science and Engineering. | | |
| 7 | **Chemical Engineering** | At least one degree in Chemical Engineering. | All areas of Chemical Engineering |
| 8 | **Data Science and Artificial Intelligence** | a) Candidates must clearly demonstrate their capability in the specialization area applied for through publications in relevant reputed venues<br>**and**<br>b) PhD in Engineering / Sciences | All areas of Data Science and Artificial Intelligence |
| 9 | **Electrical Engineering** | a) Candidates must have at least one degree in Electrical Engineering.<br>(OR)<br>b) Candidates may have degrees in Computer Science and Engineering / Physics, however, they must have a strong research record in the areas of interest to the Department of Electrical Engineering.<br>All candidates must be capable of teaching core undergraduate EE courses | (i) Wireless Communications; Speech signal processing; Radar signal processing; Statistical learning theory<br>(ii) Security of cyber-physical power systems; Design and Development of Power Converters for Microgrid and Electric Vehicles Applications with a background in experimental implementation and prototype/product development; Power Electronic Device Packaging with a |

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| | | | background in experimental implementation and prototype/product development.<br>(iii) MEMS technology; Wide bandgap semiconductor device technology; Emerging device technologies for computing, communication and sensing applications; AI/ML based modeling of semiconductor devices and processes.<br>(iv) Electronic System Design; Bio-Medical Instrumentation<br>(v) Reconfigurable RF metasurfaces; cryogenic RF systems<br>(vi) Analog, Mixed-signal, and RF IC design with tapeout and testing experience; Digital Systems Design and Architecture |
| 10 | **Engineering Design**<br><br>*(Candidates should clearly indicate the area code that they are applying for: 1.1, 1.2, 1.3,1.4,1.5, 2.1, 2.2, 2.3, 2.4, 3.1,3.2, 4.1, 4.2).* | a) Bachelor's degree in an Engineering discipline and should have clearly demonstrated domain expertise in Automotive Engineering through the PhD or Post-Doctoral research work. | (i) Automotive Engineering: Candidates with demonstrated research experience during PhD or Post-Doctoral Fellowship in the following areas:<br>1.1) Sensor Technology with demonstrated application to Autonomous Road Vehicle Design.<br>1.2) Two-Wheeled Road Vehicle Design.<br>1.3) Battery Technology with demonstrated application to Electric Road Vehicle Design.<br>1.4) Electric Machine Design with demonstrated application to Electric Road Vehicle Design<br>1.5) Software Defined Vehicles with demonstrated application to Road Vehicle Design. |
| | | b) Bachelor’s degree in Engineering Design / Electrical / Electronics / Instrumentation / Mechanical / Biomedical Engg. | (ii) Medical Device Design and Development: Demonstrated research experience during PhD or Post-Doctoral Fellowship, in developing hardware for the following applications-<br>2.1) Surgical Devices<br>2.2) Diagnostic Devices<br>2.3) Therapeutic Devices<br>2.4) Critical Care Devices |
| | | c) Bachelor's degree in an Engineering discipline and should have clearly demonstrated domain expertise in Robotics Engineering through the PhD or Post-Doctoral research work | (iii) Robotics: Demonstrated research experience during Ph.D. or Post-Doctoral Fellowship in the following areas:<br>3.1) Design and implementation of control for soft robots, continuum robots, and legged locomotion<br>3.2) Autonomous manipulation: Application of machine learning for autonomous manipulation/grasping. Applicants should have strong background in Reinforcement Learning with hardware validation and exposure to simulation-to-real transfer and related topics. |

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| | | d) Bachelor's degree in Engineering Design / Electrical / Mechanical / Production / Design / Computer Science and Engineering / Industrial Engineering | (iv) Computational and Product Design:<br>4.1) Demonstrated research experience during PhD or Post-Doctoral Fellowship (including computational approaches) in Human Factors / Form Design / Aesthetics / Interaction Design<br>4.2) Demonstrated research experience during PhD or Post-Doctoral Fellowship in applied topology optimization / biomimetic design. |
| | Research experience in the advertised areas during PhD or Post-Doctoral Fellowship should be clearly demonstrated by the candidate through appropriate publications as the First Author. | | |
| 11 | **Humanities & Social Sciences** | Ph.D. in related domain | (i) Development Studies: Political Theory, Anthropology, Urban Sociology, Political Science; Philosophy<br>(ii) IKS (Yoga, Vedanta, Vyakarana, Tarka, Ayurveda, Sanskrit Language and Literature)<br>(iii) Economics: Economic Theory (Macro, Game Theory, Behavioral and Experimental Economics) |
| 12 | **Management Studies** | a) PhD/Doctoral research in relevant areas | (i) Operations<br>(ii) Marketing<br>(iii) Organisation Behaviour and Human Resources Management<br>(iv) Finance<br>(v) Information systems<br>(vi) Integrative Management ( Global Corporate Strategy, Technology Foresight Studies, AI-Based Competitive Strategy) |
| 13 | **Mathematics** | Ph.D. in Mathematics/Statistics<br><br>*Applicants with PhD in a subject other than but related to mathematics/ statistics may be considered, provided they have an exceptionally strong record of publications in reputed mathematics journals* | (i) All areas of Mathematics / Statistics |
| 14 | **Mechanical Engineering** | At least one degree in Mechanical Engineering | All areas of mechanical engineering |
| 15 | **Medical Sciences and Technology** | a) Applicants must have earned a doctorate in Medicine/Engineering/Sciences;<br>b) All positions require experience in conducting basic and applied research and conducting clinical studies in direct collaboration with a hospital/medical school for at least two years.<br>c) Must demonstrate an excellent publication record; exhibit potential to lead and establish a strong externally sponsored research program; and must be committed to excellence in teaching at both undergraduate and graduate levels. | (i) Mathematical modelling in physiology covering one or more of the following fields – Neurology including auditory neuroscience and other related areas, Cardiovascular and respiratory physiology, Nephrology, Gastroenterology, musculoskeletal system and related areas<br>(ii) Organ specific medical imaging such as cardiac, neuro, respiratory, fetal etc. - analysis and clinical specific research<br>(iii) Organ specific device developments including implants and artificial organs - Cardiac, Neuro, Nephrology, lung etc.<br>(iv) Machine learning in medicine with demonstrated clinical applications |

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| | | | (v) Clinical research including clinical biomarker, personalized medicine and targeted therapy<br>(vi) Quantitative pharmacology. |
| 16 | **Metallurgical and Materials Engineering** | a) Ph.D. with excellent academic record with first class or equivalent at all the preceding degrees<br>b) At least one degree (Bachelor's or Master's degree) in Metallurgical or Materials Engineering. | (i) Advanced electron microscopy and spectroscopy techniques<br>(ii) Computational Materials Thermodynamics<br>(iii) Corrosion Science and Engineering<br>(iv) Fusion welding and additive manufacturing with expertise in weldability testing and fusion welding/ additive manufacturing process development<br>(v) Sustainable Metallurgy with expertise in recycling, green technologies for non-ferrous metal extraction and urban mining |
| | Candidates should demonstrate their expertise in the advertised research areas through high quality research publications as first author or corresponding author. Candidates should clearly indicate their area of specialization from the above listed reserach areas in the application. | | |
| 17 | **Ocean Engineering** | Ph.D relevant to Ocean Engineering / Naval architecture. Possess excellent academic record with first degree in engineering in Naval Architecture/Civil/ Mechanical /Ocean/Aerospace/Aeronautical Engineering. | (i) **Naval architecture:** Ship structures; Ship design & Ship building; Ship Motion / Manoeuvring; Ship hydrodynamics; Recent techniques in ship design & construction; Ship machinery & systems; Autonomous and Green ships; Marine Engineering.<br>(ii) **Ocean Engineering:** Coastal and Ocean Hydrodynamics; Offshore structure; Harbour & Coastal structures; Coastal Engineering; Offshore and Deepwater Engineering; Waterway and Port engineering, Geotechnical Engineering for Offshore and coastal structures, Instrumentation in Ocean Engineering. |
| | | Ph.D. in Petroleum Engineering. Possess excellent academic record with first degree in petroleum engineering. | **(iii) Petroleum Engineering:** Production Engineering, Drilling Engineering, Completion and Workover Operations, Facilities Engineering, Natural Gas Engineering, Unconventional Energy Sources, Low Emission Oil & Gas Production Systems, and Carbon Capture Utilization and Storage (CCUS). |
| 18 | **Physics** | Candidates should have a PhD in **Physics** or in any closely related disciplines. If Ph.D is in a closely related discipline, at least one degree (Bachelors or Masters) should be in Physics with first class or equivalent at the preceding degree with a consistently good academic record throughout. Candidates should have at least three years of industrial, research, or teaching experience after Ph.D. | All areas of Physics |