

PhD Programme Table - 38th cycle
NRRP “National Recovery and Resilience Plan” Call for Applications



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NextGenerationEU



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Section “Available Positions and Scholarships” integrated on 01/07/2022

Section “Available Positions and Scholarships” integrated on 13/07/2022

Section “Available Positions and Scholarships” integrated on 25/07/2022

Section “Available Positions and Scholarships” integrated on 03/08/2022

PROGRAMME’S NAME	MECHANICS AND ADVANCED ENGINEERING SCIENCES (DIMSAI)
DURATION	3 years
PROGRAMME START DATE	01/11/2022 (DD/MM/YYYY)
LANGUAGES	Italian, English
COORDINATOR	Prof. Lorenzo Donati (l.donati@unibo.it)
CURRICULA	<ol style="list-style-type: none"> 1. Engineering and Industrial Design, Machine Construction, Metallurgy, and Manufacturing Technologies 2. Fluid Machinery, Energy Systems, Mechanics of Machines, and Industrial Mechanical Plants 3. Thermal Physics, HVAC Systems, Acoustics, Nuclear Technologies and Industrial Applications of Plasmas
RESEARCH TOPICS	Detailed list at the bottom of the present document
PhD POSITIONS	26
ADMISSION PROCEDURE	Qualifications and research proposal evaluation Oral examination

Available Positions and Scholarships

Pos. n.	Financial Support	Description	Curriculum	Positions linked to a specific research topic
1	PhD Scholarship Ex M.D. 351/2022 - NRRP Research	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 1, Investment 4.1 (MD 351/2022) – NRRP Research	1	Carbon footprint reduction by using secondary aluminum alloys in conventional and innovative processes: microstructural and mechanical characterization
2	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by FAAC S.p.A.	2	Distribution logistics optimization models: improvement of economic performance and customer service

3	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by IMA S.p.A.	2	Intelligent Systems for the Innovation of the Automatic Machinery Industry
4	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and Marposs S.p.A.	1	Industry 4.0 technologies applied to a mechanical smart manufacturing system. Big data elaborations to define and test algorithms for monitoring diagnostic maintenance safety quality and management.
5	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by C.P.C. group	1	Development, characterization and simulation of components produced with sustainable polymer matrix composites
6	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by C.P.C. group	1	Development, characterization and simulation of components produced with sustainable polymer matrix composites
7	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by C.P.C. group	1	Development, characterization and simulation of components produced with sustainable polymer matrix composites: bonding and painting of composite materials
8	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by Phononic Vibes srl	3	Sonic crystals and metamaterials as sound barriers for high absorption, ventilation and insulation
9	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by Ducati Motor Holding SpA	1	Process optimization, heat treatment and surface modification for an increase in the mechanical, fatigue and tribological performance of traditional and innovative Titanium alloys produced by Laser Powder Bed Fusion for applications in motor vehicle components
10	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by Nuovo Pignone Tecnologie S.r.l. - Baker Hughes	3	Design oriented modelling of plasma assisted methane pyrolysis
11	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by TeCh srl	2	Methods and tools for reducing patient risk through minimally invasive surgery

12	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by AdapTronics	2	Development of thin film electrostatic transducers using digital printing techniques
13	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by BUCCI AUTOMATIONS SPA	2	Condition monitoring and vibration analysis of automatic bar feeders through advanced techniques
14	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by BUCCI AUTOMATIONS SPA	1	Development of experimental, numerical and predictive models of the fatigue life of machine components automatic.
15	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by AMMAGAMMA	3	Development and implementation of forecasting, model predictive control and image analysis tools in plasma and nuclear reactor physics.
16	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by Alma Automotive srl	2	Application of artificial intelligence techniques to condition monitoring and predictive maintenance of mechanical components
17	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by Turtle s.r.l.	2	Analysis and measurement of environmental, social and economic sustainability in companies, through the development and application of the VIVACE software.
18	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by Saint Gobain Italia s.p.a	3	Analysis of innovative solutions and evaluation of design robustness for acoustic comfort in teaching and work environments
19	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by Rothoblaas	3	Acoustic and mechanical characterization of solutions and systems for the acoustic insulation of wooden buildings
20	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by SMEG Spa	3	Dynamic thermo-fluid simulations of heating and cooling cavities
21	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by EMODIAL Srl	1	Industrial engineering design and methods applied to the three-dimensional simulation of new medical devices

22	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by Bonfiglioli spa	2	Innovative gearboxes for robotic applications
23	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by Bi-Rex	1	Integrated Mechatronic-IT Design for Cyber-physical Smart Components and Systems in composite materials and Additive Manufactured Electronics
24	PhD Scholarship Ex M.D. 352/2022	Funded by the EU - NextGenerationEU with funds made available by the National Recovery and Resilience Plan (NRRP) Mission 4, Component 2, Investment 3.3 (MD 352/2022) and by C.P.C. group	1	Development, characterization of composite materials with polymeric matrix and new processing technologies for sustainable mobility: Functional evaluation and LCA of composite components from renewable sources for production of sustainable fiber-reinforced composites.
25	PhD position without scholarship		1	Design and methods of Industrial Engineering applied to three-dimensional digital simulation in the orthopedic field
26	PhD Scholarship	Funded by Cefla s.c.	2	Development of mechatronics solutions for automated systems for painting and finishing

Applicants awarded with Ex M.D. 351/2022 or Ex M.D. 352/2022 PhD scholarships shall have specific obligations (i.e. mandatory research periods abroad and/or in a firm) during their PhD programme. For detailed information, refer to the Call for Applications, articles 1.2 and 1.3, and to the text of the law.

For any other eventual PhD positions, a 3-month research period abroad is mandatory.

Admission Exams

The admission exams detailed schedule shall be published **starting from July 12th, 2022:**

- on the [University website](#), selecting the relevant PhD Programme > “More information”, at the bottom of the page in the section “Notices”;
- on [Studenti Online](#) (select “summary of the requests in progress” > “see detail” and open the .pdf file at the bottom of the page). **No personal written communication will be sent to applicants.**

Required and Supporting Documents to be attached to the application

All the documents listed below **shall be drawn up in English or Italian.** In case of documents originally issued in any other language (e.g. identity document, qualifications), an official translation is required.

Only qualifications obtained **during the last 5 calendar years** shall be taken into consideration, except for the University Degree. The Admission Board will assess the relevance of the supporting documents to the PhD Programme.

REQUIRED DOCUMENTS	
Identity document	Valid identity document with photo (i.e. identity card, passport)
Curriculum Vitae	No specific CV format is required

Degrees	Documents attesting the awarding of the first and second cycle degrees, the exams taken and the marks obtained (see Art. 3 of the Call for Applications)
Research proposal	Multi-annual research proposal, with special emphasis on the activities to be completed during the first-year course . The proposal must meet the following requirements: <ul style="list-style-type: none"> - it cannot exceed 20,000 characters, including spaces and formula possibly used. This figure does not include: the title of proposal, the outline, references and images (such as graphs, diagrams, tables, etc. - if present); - it must include: the state of the art; description of the proposal; expected results; references.
SUPPORTING DOCUMENTS	
Thesis abstract	Abstract of the second cycle degree thesis . Graduands applicants may submit the draft of the thesis. Abstracts cannot exceed 5,000 characters, including spaces and formula possibly used. The above figure does not include: the title of the thesis, the outline, references, and images such as graphs, diagrams, tables etc.
Publications	Lists of publications (i.e. monographs, articles on scientific journals) and minor publications (conference papers, etc.)
Other documents	<ul style="list-style-type: none"> - Research activity of any kind - whether basic, applied, translational, etc. - carried out in any capacity, including when covered by research grants, and as a staff member of research projects - Documents attesting the applicant's foreign languages proficiency - Periods of study abroad, completed by applicants outside their countries of origin (e.g. Erasmus programme or other similar mobility programmes) - Other qualifications attesting the suitability of the applicants (scholarships, prizes, vocational programmes, etc.)

Evaluation criteria*

Scores will be expressed in points out of 100, as follows.

1. Qualifications and research proposal evaluation

Minimum score for admission to the oral examination: 30 points, Maximum score: 50 points

Qualifications evaluation	First (Bachelor's) and second cycle (Master's) degrees final marks. Graduands shall be evaluated according to the Weighted Average Mark (WAM)	20 points max
	Publications and other qualifications attesting the applicant's training and skills	5 points max
Research proposal evaluation	Scientific value and ground-breaking nature of the proposal	15 points max
	Structure of the proposal	5 points max
	Proposal feasibility	5 points max

2. Oral examination

Minimum score for eligibility: 30 points, Maximum score 50 points

English language proficiency	5 points max
Applicant's suitability for academic research and knowledge of the topics connected to the research proposal	30 points max
General knowledge of issues encompassed by the Master's degree thesis	15 points max

Oral examination aims to assess the suitability of the applicant for scientific research as well as the general knowledge of issues encompassed by the PhD Programme (see the list of [research topics](#) at the bottom of the present document).

During the oral examination, the applicant's English language proficiency shall be assessed.

The oral examination is carried out in Italian or in English.

* Possible further evaluation criteria will be available on the [University website](#), selecting the relevant PhD Programme > "More information".

Research Topics

Curriculum 1 - Engineering and Industrial Design, Machine Construction, Metallurgy, and Manufacturing Technologies

The curriculum pursues the education of researchers and high-qualified engineers, operating in the fields of Mechanical Engineering and able to address issues related to design and research activities in disciplines such as:

- Tribological behavior of metallic materials, with and without surface modifications

- Metallurgical features of metallic components produced by innovative process, such as additive manufacturing
- Mechanical design and structures
- Microstructure and mechanical properties of advanced metals and metal matrix composites
- Experimental stress analysis, characterization and development of constitutive models
- Design methods and tools in industrial engineering
- Mechanical technologies and materials.

Curriculum 2 - Fluid Machinery, Energy Systems, Mechanics of Machines, and Industrial Mechanical Plants

The curriculum includes different subjects, ranging from internal combustion engines to industrial mechanical plants. For the cultural fields Internal Combustion Engines, Fluid Machinery, Energy Conversion Systems the curriculum studies fluid machinery and energy conversion systems, addressing thermodynamic, fluid dynamic, energetic, ecological and technological issues by means of modeling, control and testing.

In particular, the main research areas are:

- Modeling, control and testing of internal combustion engines and hybrid vehicles
- Fluid dynamics simulation of internal combustion engines and fluid machinery
- Numerical and experimental analysis in the field of gas turbines, combined cycles, steam engines, prime movers, and integrated systems for the processing and storage of energy from renewable and non-renewable sources.

For the cultural fields Mechanics of Machines and Industrial Mechanical Plants the curriculum comprises scientific and operative issues concerning the analysis, design and management of devices, machines, processes and industrial plants, through the adoption of a systemic approach and of methodologies drawn from theoretical, applied and experimental mechanics, industrial plants and production. The main research areas are:

- Automation, robotics and mechatronics
- Biomechanics
- Vehicles, transport and lifting systems
- Dynamics and machine vibrations
- Monitoring, diagnostics and prognostics of mechanical systems
- Industrial plants and production systems
- Maintenance and industrial safety
- Instrumentation
- Logistics and operations.

Curriculum 3 - Thermal Physics, HVAC Systems, Acoustics, Nuclear Technologies and Industrial Applications of Plasmas

- Heat transfer and convection theory
- Thermal analysis of porous media
- Thermal and fluid-dynamic aspects of single-phase and two-phase flows in conventional devices and microdevices (microfluidics)
- Applied thermal engineering and HVAC systems
- Heat exchangers and heat recovery systems
- Renewable energy for HVAC (heat pumps, solar plants)
- Environmental acoustics, building acoustics, architectural acoustics, sound absorbing materials and systems, noise control techniques, digital processing of acoustic signals and lightning
- Energy efficient buildings
- Design of nuclear plants
- Radioprotection
- Risk analysis and safety
- Modelling of neutron, charged particle and photon transport
- Applications of nuclear technologies to medicine, industry and cultural heritage
- Direct Numerical Simulation (DNS) of two-phase flow
- Development and validation of advanced computing platforms
- Thermo-hydraulics of advanced nuclear reactors
- Reliability and risk analysis at the system level
- Calculation of thermodynamic and transport properties of plasmas
- Physical modelling and design-oriented simulation of plasma assisted processes
- Diagnostics of plasma sources and processes
- Biomedical applications of cold atmospheric plasmas and plasma medicine.