# Annex 4 – List of descriptors

**Chemistry (CHE)**

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| **C1 – Inorganic Chemistry** | | |
| Bioinorganic chemistry | Catalytic materials | Coordination chemistry |
| Chemistry of non-metals | Inorganic chemistry | Organometallic chemistry |
| Radiation and nuclear chemistry | Solid state materials | |
| **C2 – Organic, Polymer and Molecular Chemistry** | | |
| Carbohydrates | Chirality | Click chemistry |
| Combinatorial chemistry | Heterocyclic chemistry | Macromolecular chemistry |
| Molecular architecture and structure | Molecular chemistry | Natural product synthesis |
| Nucleic acid chemistry | Organic chemistry | Organic reaction mechanisms |
| Peptide chemistry | Polymer chemistry | Stereochemistry |
| Supramolecular chemistry | Synthetic organic chemistry | |
| **C3 – Physical and Analytical Chemistry** | | |
| Analytical chemistry | Chemical instrumentation and instrumental techniques | Chemical reactions: mechanisms, dynamics, kinetics and catalytic reactions |
| Chemistry of condensed matter | Crystallography and X-ray diffraction | Chromatography |
| Colloid chemistry | Corrosion | Crystallisation |
| Electrochemistry, electro dialysis, microfluidics, sensors | Forensic chemistry | Homogeneous catalysis |
| Heterogeneous catalysis | Ionic liquids | Magnetic resonance |
| Mass spectrometry | Method development in chemistry | Microscopy |
| Molecular dynamics | Molecular electronics | Photocatalysis |
| Photochemistry | Physical chemistry | Physical chemistry of biological systems |
| Quantum chemistry | Separation techniques/extraction | Spectroscopic and spectrometric techniques |
| Surface chemistry | Theoretical and computational chemistry | Trace analysis |
| **C4 – Applied and Industrial Chemistry** | | |
| Batteries | Biological chemistry, biochemistry | Biomaterials, biomaterial synthesis |
| Ceramics | Coating | Enzymology |
| Food chemistry | Fuel cells | Graphene, carbon nanotubes |
| Green chemistry | Hydrogen production/storage | Intelligent materials, self-assembled materials |
| Materials for sensors | Medicinal chemistry | Nanochemistry |
| Nano-materials: oxides, alloys, composite, organic-inorganic hybrid, nanoparticles | Pharmaceutical processes and production, Regulatory aspects, quality assurance, good manufacturing practice | Plastics |
| Porous materials, metal organic framework (MOFs) | Solar cells | Structural properties of materials |
| Surface modification | Targeted drug delivery/discovery | Thin films |
| Toxicology | Water splitting | Water treatment/purification |

**Economic Sciences (ECO)**

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|---|---|---|
| **E1 – Economics** | | |
| Applied research econometrics | Behavioural and experimental economics | Economic geography |
| Economic growth | Economic history | Economics of education |
| Environment economics | Financial econometrics | Game theory |
| Global macroeconomic challenges | Health economics | Industrial economics |
| International trade | Labour economics | Macroeconomics theory |
| Monetary economics, international finance | Political economy | Public economics |
| Social economics, welfare economics | Statistics and big data | Urban and regional economics |
| **E2 – Economic Development** | | |
| Circular economy | Cluster development | Environment issues in development economics |
| Key enabling technologies for development | Natural resources management | Public administration |
| Research & Open innovation, competitiveness | | |
| **E3 – Management** | | |

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|---|---|---|
| Corporate governance and management | Human resources management | Industrial organisation |
| Research and innovation management | Start-up's, new business models in entrepreneurship, social entrepreneurship | Strategy, marketing |
| Value chain and optimisation | | |
| **E4 – Finance** | | |
| Accounting, international accounting standards, reporting, tax issues related to accounting | Banks, insurance companies, financial intermediaries & fund, credit rating agencies | Corporate finance, fundamentals analysis, capital budgeting, venture capital, risk assessment |
| Financial markets, stock markets, fixed income markets, other markets investments, asset pricing, bonds, derivatives, commodities | | |

**Information Science and Engineering (ENG)**

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|---|---|---|
| **G1 - Computer science and informatics** | | |
| Algorithms, distributed, parallel and network algorithms, algorithmic game theory | Artificial intelligence, intelligent systems, multi agent systems | Bioinformatics, e-Health, medical informatics |
| Cognitive modelling, cognitive engineering, cognitive sciences | Complexity and cryptography, electronic security, privacy, biometrics | Theorem proving, symbolic, algebraic computations |
| Pervasive computing, ubiquitous computing, ambient intelligence, internet of things | Computer games, computer geometry, multi-media, augmented and virtual reality | Computer graphics, computer vision, multimedia, computer games |
| Parallel/distributed systems, GPGPU, grid, cloud processing systems | E-commerce, e-business, computational finance | E-learning, user modelling, collaborative systems |
| Intelligent robotics, cybernetics | Internet and semantic web, ontologies, database systems and libraries | Machine learning, data mining, statistical data processing and applications |
| Modelling engineering, human computer interaction, natural language processing | Numerical analysis, simulation, optimisation, modelling tools | Scientific computing and data processing |
| Sensor networks, embedded systems, hardware platforms | Software engineering, operating systems, computer languages | Neural networks, connectionist systems, fuzzy logic |
| Evolutionary computing, biologically-inspired computing | Theoretical computer science, formal methods | Quantum computing, DNA computing, photonic computing |
| **G2 - Systems and Communication Engineering: Electrical, electronic, communication, optical and systems engineering** | | |
| Control Engineering | Diagnostic and implantable devices, environmental monitoring | Electrical and electronic engineering: semiconductors, components, systems |
| Electronics, photonics | Human-computer-interfaces | Nano engineering |
| Networks (communication networks, sensor networks, networks of robots,etc.) | Optical engineering, photonics, lasers | Signal processing |
| Simulation engineering and modelling | Systems engineering, sensorics, actorics, automation | Wireless communications, communication, high frequency, mobile technology |
| **G3 - Products and Processes Engineering: Product design, process design and control, construction methods, civil engineering, energy processes, material engineering** | | |
| Aerospace engineering | Architecture, smart buildings, smart cities, urban engineering | Chemical engineering, technical chemistry |
| Civil engineering | Computational engineering and computer aided design | Energy collection, conversion and storage, renewable energy |
| Energy systems, smart energy, smart grids, wireless energy transfer | Environmental engineering and geotechnics | Fluid mechanics, hydraulic-, turbo-, and piston engines |
| Industrial bioengineering | Industrial design (product design, ergonomics, man-machine interfaces, etc.) | Lightweight construction, textile technology |
| Maritime engineering | Materials engineering | Mechanical and manufacturing engineering (shaping, mounting, joining, separation) |
| Production technology, process engineering | Sustainable design (for recycling, for environment, eco-design) | Transport engineering, intelligent transport systems |
| Waste treatment | | |

**Environmental and Geosciences (ENV)**

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|---|---|---|
| **V1 - Environment and society** | | |
| Clean technologies, circular economy, life | Environmental determinants of health | Environmental regulations, climate |

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| cycle assessment | | negotiations and citizen science |
| Environmental risk assessment, monitoring | Mobility and transportation | Social and industrial ecology, sustainable development |
| Spatial and regional planning (including landscape and land management), GIS | Urbanization and urban planning, cities | Waste, by-products and residue management (including from agriculture) |
| **V2 - Earth system science** | | |
| Atmospheric chemistry, atmospheric composition, air pollution, indoor air quality | Biogeochemistry, biogeochemical cycles | Clean exploration and exploitation of natural resources |
| Climatology and climate change | Cryosphere, dynamics of snow and ice cover, sea ice, permafrost and ice sheets | Earth observations from space/remote sensing |
| Environmental chemistry, environmental forensics | Geochemistry, crystal chemistry, isotope geochemistry | Geology, tectonics, volcanology, physics of earth's interior, seismology |
| Hydrology, water management | Meteorology, atmospheric physics and dynamics | Mineralogy, petrology, igneous petrology, metamorphic petrology |
| Natural hazards | Noise pollution | Oceanography, marine science, coastal engineering |
| Paleoclimatology, paleoecology | Physical geography | Pollution (water, soil, sediment), rehabilitation and reconstruction of polluted areas, clean technologies |
| Sedimentology, soil science, palaeontology | Terrestrial ecology, land cover change | |
| **V3 - Evolutionary, population and environmental biology** | | |
| Animal behaviour | Biogeography, macro-ecology | Biodiversity, conservation biology |
| Comparative biology | Ecology | Ecotoxicology |
| Environmental, marine and freshwater biology | Population biology, population dynamics, population genetics | Species interactions (e.g. food-webs, symbiosis, parasitism, mutualism, bio-invasion) |
| Systems evolution, biological adaptation, phylogenetics, systematics | | |
| **V4 - Food Science, Agriculture, Forestry and Non-Medical Biotechnology** | | |
| Agriculture production systems (animals) | Agriculture production systems (crops), including fertilisation and nutrient management | Applied plant biology |
| Applied biotechnology (non-medical), bioreactors, applied microbiology | Aquaculture, fisheries | Biohazards, biological containment, biosafety, biosecurity |
| Biomass and biofuels production | Biomimetics | Crop protection, pest and disease control |
| Environmental biotechnology, bioremediation, biodegradation | Food sciences, safety, traceability, authenticity, agroindustry | Forestry and forest management, agroforestry |
| Soil biology, soil functionality, soil management | | |

**Life Sciences (LIF)**

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|---|---|---|
| **L1 - Molecular and Structural Biology** | | |
| Biophysics (e.g. transport mechanisms, bioenergetics, fluorescence) | DNA synthesis and degradation | DNA repair and recombination |
| Molecular metabolism | Molecular interactions | Protein synthesis, folding, modification and turnover |
| Lipid synthesis, modification and turnover | Carbohydrate synthesis, modification and turnover | RNA synthesis, processing, modification and degradation |
| Structural biology (e.g. crystallography, EM, NMR, PET) | | |
| **L2 - Genetics, Genomics, Bioinformatics and Systems Biology** | | |
| Applied genetic engineering, transgenic organisms, recombinant proteins, biosensors | Bioinformatics | Biological systems analysis, modelling and simulation |
| Biostatistics | Computational biology | Epigenetics and gene regulation |
| Genetic epidemiology | Genomics and functional genomics | Genetic and genomic variation and related disorders |
| Comparative, evolutionary and population genomics | Chromosome structure organisation and dynamics | Metabolomics (including glycomics) |
| Molecular genetics, reverse genetics and RNAi | Proteomics | Quantitative genetics |

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| Systems biology | Transcriptomics | Plant genetics |
| Genome editing | Genetic pharmacology | |
| **L3 - Cellular and Developmental Biology** | | |
| Developmental biology and technology | Pattern formation and embryology in animal organisms | Molecular transport mechanisms |
| Mechanisms of growth control and cell proliferation | Cell differentiation, physiology and dynamics | Morphology and functional imaging of cells |
| Organelle biology | Plant development pattern formation and embryology in plants | Molecular mechanisms of signal transduction |
| Stem cells and cellular programming | Mechanisms and dynamics of cell migration | |
| **L4 - Physiology, Pathophysiology and Endocrinology** | | |
| Ageing | Cancer and its biological basis | Cardiovascular diseases |
| Comparative physiology | Endocrinology | Metabolism, biological basis of metabolism related disorders |
| Organ physiology and pathophysiology | Environmental physiology | Rare/orphan Diseases |
| Reproductive biomedicine (reproductive physiology and endocrinology, infertility and pregnancy research) | | |
| **L5 - Neurosciences and neural disorders** | | |
| Behavioural neuroscience (e.g. sleep, rhythms, speech, handedness) | Cognitive neuroscience (e.g. learning, memory, emotions, consciousness) | Neural development and neuroplasticity |
| Mechanisms of pain | Molecular and cellular neuroscience | Neuroanatomy and excitability |
| Physiology of nerves and motor systems | Medicines, psychoactive drugs and pharmacology, poison. | Neuroimaging and computational neuroscience |
| Neurological disorders (e.g. Alzheimer's disease, Huntington's disease, Parkinson's disease) | Psychiatric disorders and clinical psychology (e.g. schizophrenia, autism, Tourette's syndrome, obsessive compulsive disorder, depression, bipolar disorder, attention deficit hyperactivity disorder, addiction) | Sensory perception (nose and smell, tongue and taste, eyes and vision, ears and hearing, skin, pain, touch and movements) |
| **L6 - Immunity and infection** | | |
| Bacteriology | Biological basis of cancer immunity | Biological basis of auto-immunity/tolerance |
| Biological basis of immunity related inflammatory disorders | Biological basis of other immunity related disorders | Cellular and adaptive immunity |
| Immunogenetics | Immunological memory and tolerance | Immunosignalling |
| Microbiology | Parasitology | Phagocytosis and innate immunity |
| Prevention and treatment of infection by pathogens (e.g. vaccination, antibiotics, fungicide) | Veterinary medicine and infectious diseases in animals | Virology |
| **L7 - Diagnostic tools, therapies and public health** | | |
| Diagnostic tools (e.g. genetic, molecular diagnostic) | Drug discovery and design (formulation and delivery) | Drug therapy and clinical studies |
| In vivo bio and medical imaging | In vitro cell and tissue imaging | Environment and health risks, occupational medicine |
| Gene therapy, cell therapy, regenerative medicine | Tissue regeneration and engineering | Immunotherapy (vaccine discovery, genetic vaccines) |
| Health services, health care research | Medical engineering and technology | Personalised medicine (diagnostic/prognostic biomarker, patient-orientated management solutions) |
| Pharmacology, pharmacogenomics | Public health and epidemiology | Radiation therapy |
| Surgery | | |

**Mathematics (MAT)**

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|---|---|---|
| **M1 - Mathematics** | | |
| Algebraic geometry | Algebraic number theory | Algebraic topology |
| Algorithms and complexity | Analytic number theory | Category theory and algebraic structures |
| Combinatorics | Complex analysis | Complex geometry |
| Differential Geometry | Functional analysis | Game Theory |
| General topology | Graph Theory | Group Theory |
| Harmonic analysis | Homological algebra | Low dimensional topology |
| Mathematical logic and set theory | Non commutative Geometry | Ordinary Differential Equations and |

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| | | Dynamical Systems |
| Partial Differential Equations | Probability | Ring theory |
| Set theory | | |
| **M2 – Applied Mathematics** | | |
| Control Theory | Data Analysis | Mathematical aspects of Biology |
| Mathematical aspects of Computer Science | Mathematical aspects of Economy and Finance | Mathematical aspects of Physics |
| Mathematics in Engineering and other Applied Sciences | Numerical analysis and scientific computing | Operational Research |
| Optimization | Scientific Computing | Statistics |

**Physics (PHY)**

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|---|---|---|
| **P1 – Particle and Nuclear Physics** | | |
| Fundamental interactions and fields | Neutrino oscillations | Nuclear physics, heavy ions |
| Nuclear physics, nuclear structure | Particle accelerators and detectors | Particle physics, experiment |
| Particle physics, theory/phenomenology | Supersymmetric particles | Quantum chromodynamics |
| Quantum field theory | | |
| **P2 – Atomic and molecular physics, optics** | | |
| Atomic physics | Chemical Physics | Cold/Ultra-cold atoms and molecules |
| Laser physics | Metrology and measurement | Molecular physics |
| Nano-optics | Non linear optics | Interferometry |
| Optical physics | Photonics | Statistical physics (gases) |
| Quantum optics | Quantum electrodynamics | |
| **P3 - Condensed matter physics** | | |
| Condensed matter, thermal properties | Condensed matter, transport properties | Condensed matter, mechanical and acoustical properties, lattice dynamics |
| Electronic properties of materials, surfaces, interfaces | Films and Interfaces | Fluid dynamics |
| Gas and plasma physics | High pressure physics | Low-temperature physics |
| Magnetism and strongly correlated systems | Mesoscopic physics | Nanophysics: nanoelectronics, nanophotonics, nanomagnetism, nanoelectromechanics, etc. |
| Phase transitions, phase equilibria | Polymer physics | Semiconductors and insulators |
| Soft condensed matter | Spintronics | Statistical mechanics (condensed matter) |
| Structure of solids and liquids | Superconductivity | Superfluids |
| Surface Physics | | |
| **P4 – Astrophysics, Cosmology, Space science** | | |
| Active Galactic Nucleus (AGN) , QSO | Astrobiology, astrochemistry | Astrometry |
| Astronomical instrumentation: telescopes, detectors, techniques | Astrophysical jets, accretion phenomena | Big bang nucleosynthesis |
| Clusters of galaxies and large scale structures | Cosmic Microwave Background (CMB) | Cosmology |
| Dark matter, dark energy | Formation and evolution of galaxies | Formation, structure and evolution of stars |
| Extrasolar planets and exoplanets | Gravitational lensing | Gravitational waves |
| High energy astrophysics | Interstellar medium | Nuclear astrophysics |
| Radio astronomy | Relativistic astrophysics | Solar physics |
| Solar system and planetary science | Space weather | |
| **P5 – Applied physics** | | |
| Acoustics | Agrophysics | Biophysics and biophysical techniques |
| Communication Physics | Complex systems, Networks | Computational Physics |
| Geophysics | Laser applications | Medical Physics |
| Nanotechnology: nanomaterials, tools and techniques, applications of nanotechnology | Optical engineering | Optoelectronics |
| Photodetectors | Photonics applications | Photovoltaics and solar cells |
| Plasmonics | Quantum electronics | Quantum Technology and Quantum Devices |
| Solid-state devices | | |

**Social Sciences and Humanities (SOC)**

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|---|---|---|
| **S1 - Sociology, social anthropology** | | |
| Ageing, health social policies | Attitudes and values | Demography, population issues and policies |
| Fertility, family dynamics, policies | Gender studies | Globalization, glocalization, antiglobalism |
| Inequalities, discrimination, prejudice, aggression and violence, antisocial behaviour | Kinship, cultural dimensions of classification and cognition, identity | Migration, refugees, asylum, interethnic relations, conflicts and integration of migrants |
| Myth, ritual, symbolic representations, religious studies | Qualitative methods, ethnography, case studies | Rural population, agriculture, innovation, depopulation |
| Social economy, social entrepreneurship | Social influence, power and group behaviour, classroom management | Social integration, exclusion, inequalities, participation and prosocial behaviour |
| Social structure, social mobility | Social theory | Social welfare and neoliberalism |
| Sociology of education | Sociology of knowledge | Transformation of societies, democratization, social movements |
| Urban sociology, urban theory, urban studies, global cities, territorialisation | Work, employment, precariousness | Youth studies |
| **S2 - Political science** | | |
| Comparative politics | Development studies | Electoral politics, Political parties, Citizenship and public engagement |
| EU and European politics | Foreign policy | Game theory, Logic of collective choice |
| Human, economic and social geography | International relations, Global governance, International politics and history; geopolitics | Migration policy |
| Political economy | Political systems and institutions, governance | Political theory, Political thought, Political philosophy; Ideologies |
| Politics of gender, Race, Discrimination and inequalities; Identity politics | Public administration, Public policies | Regional and territorial politics |
| Relations with public interest groups | Theories of conflict, violence and security; Negotiation and mediation | |
| **S3 - Law** | | |
| Business, corporate and securities law | Comparative law | Criminal law |
| Education law | Employment and labour law, social law | European law |
| Family and juvenile law | Health law | Intellectual property and innovation law; Data protection law, IT law |
| International law, human and civil rights; Violence, conflict and peacebuilding | Legal systems, constitutions, foundations of law | Private law, consumer protection law |
| Public law, immigration law, environmental law | Sports and entertainment law | |
| **S4 - Communication** | | |
| Communication networks, media, including social media, information society | Crisis communication theory and procedures | Digital social research, audiovisual social services |
| Information & communication technology and the world of work | Information society and education | Institutional communication |
| Lobbying | Political communication and strategy | Social communication, verbal and non verbal communication |
| Social studies of science and technology | | |
| **S5 - Cognition, psychology, linguistics** | | |
| Biological psychology: mind-body connection, health, stress and disease | Cognitive psychology: learning, cognition | Development across the life-span and developmental psychopathology |
| Ergonomics, human factors, user modelling, and neuroergonomics | Evolution of mind and cognitive functions, animal communication | Formal, cognitive, functional and computational linguistics |
| Neuropsychology and neurolinguistics | Psycholinguistics: acquisition, comprehension , production | Socio-cultural psychology and social cognition |
| Typological, historical and comparative linguistics | Use of language: pragmatics, sociolinguistics, discourse analysis, second language teaching and learning, lexicography, terminology | |
| **S6 – Philosophy** | | |
| Aesthetics and philosophy of culture and anthropology | Analytic philosophy | Epistemology, logic, philosophy of science |
| Ethics and morality, bioethics | History of philosophy | Metaphysics |
| Phenomenology | Philosophy of religion | Social and political philosophy |

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| **S7 – Education** | | |
| Education systems, institutions and policies, sociology of education | Educational assessment, feedback | Learning technologies, e-learning, tutoring systems, learning analytics |
| Lifelong learning, workplace learning and training, heutagogy | Philosophy of education, human development | Teaching and learning methodologies, pedagogy, andragogy, psychology of education |
| **S8 - Literature, arts, music, cultural and comparative studies** | | |
| African literature | Classics, ancient Greek and Latin literature and art | Comparative literature |
| Computational modelling and digitisation in the cultural Sphere | Contemporary literature | Cultural memory, intangible cultural heritage |
| Cultural studies, cultural diversity | History of art and architecture, arts-based research | History of art criticism |
| History of books, codicology | History of collections | History of fashion design |
| History of literature | Latin American literature | Library and archival science; Librarianship |
| Literary theory and comparative literature, literary styles | Medieval literature | Modern literature |
| Museums and exhibitions, conservation and restoration | Music and musicology, history of music | Oriental and East Asian literature |
| Textual philology, palaeography and epigraphy | Visual arts, performing arts, film, design | |
| **S9 - Archaeology, history and memory** | | |
| American archaeology, art and culture | Ancient history | Asian archaeology, art and culture |
| Classical archaeology and art, history of archaeology | Collective memories, identities, lieux de mémoire, oral history | Colonial and post-colonial history, global and transnational history, entangled histories |
| Cultural heritage, cultural memory | Cultural history; History of collective identities and memories | Diplomatics |
| Early and modern archaeology | Egyptology and ancient near eastern archaeology, art and culture | Gender history |
| General archaeology, archaeometry, landscape archaeology | Historiography, theory and methods in history, including the analysis of digital data | History of ideas, intellectual history, history of science, techniques and technologies |
| Industrial archaeology | Medieval history | Military history |
| Modern and contemporary archaeology | Modern and contemporary history | Numismatics, epigraphy |
| Prehistory, palaeoanthropology, palaeodemography, protohistory | Social, economic, cultural and political history | |