

AC distribution networks

BT	distribution networks
RT	capacitor switching
	distributed power generation
	load flow
	power distribution control
	power distribution economics
	power distribution faults
	power distribution reliability
	power grids
	power stations
	power systems
	reactive power
	smart power grids
	substations
	traction power supplies
	transmission networks
PT	distribution networks
CC	B8120J Distribution networks
	C3340H Control of electric power systems
	C7410B Power engineering computing
DI	January 2025

AC transmission networks

BT	transmission networks
RT	distribution networks
	flexible AC transmission systems
	load flow
	power grids
	power system interconnection
	power transmission control
	power transmission economics
	power transmission faults
	power transmission lines
	power transmission planning
	reactive power
	smart power grids
	transmission network calculations
PT	transmission networks
CC	B8120E a.c. transmission
DI	January 2025

adversarial machine learning *[promoted lead-in]*

UF	machine learning security
	security of neural nets
BT	computer crime
	machine learning
RT	adversarial neural nets
	computer network security
	deep learning (artificial intelligence)
	federated learning
	image classification
	invasive software
	neural nets
	pattern classification
	reinforcement learning
	security of hardware
	supervised learning
	transfer learning (artificial intelligence)
	unsupervised learning
PT	computer crime
	learning (artificial intelligence)
CC	C1230L Learning in AI (theory)
	C5480 Security aspects of hardware
	C6130S Data security
	C6260 Machine learning (artificial intelligence)
DI	January 2025

adversarial neural nets

BT	deep learning (artificial intelligence)
NT	generative adversarial networks
RT	convolutional neural nets
	feature extraction
	generative AI
	pattern classification
	recurrent neural nets
	reinforcement learning
	unsupervised learning
PT	neural nets
CC	B1295 Neural nets (circuit implementations)
	C1230D Neural nets (theory)
	C1230L Learning in AI (theory)
	C5190 Neural nets (circuit implementations)
	C6264 Neural nets
DI	January 2025

agricultural computing

BT	agriculture computer applications
RT	agricultural engineering agricultural robots crops farming geophysical image processing image processing plant diseases remote sensing robot vision soil vegetation mapping
PT	agriculture
CC	C7860 Agriculture, forestry and fisheries computing E0410 Information technology applications E3010 Agriculture
DI	January 2025

atmospheric convection

BT	atmospheric movements convection
RT	atmospheric boundary layer atmospheric temperature atmospheric thermodynamics atmospheric turbulence
PT	atmospheric movements convection
CC	A9260E Convection, turbulence, and diffusion in the lower atmosphere A9410L Convection, diffusion, mixing, and turbulence in the upper atmosphere A9420T Ionospheric plasma motion, convection, and circulation A9430F Magnetospheric plasma motion, convection, and circulation
DI	January 2025

autonomous driving

UF	automated driving self-driving cars
BT	automotive control road vehicles
RT	advanced driver assistance systems automotive computing driver information systems human factors intelligent transportation systems mobile robots object detection public safety road safety road traffic road traffic control robot vision traffic engineering computing unmanned ground vehicles velocity control
PT	automotive control
CC	C0130 Economic, social and political aspects of control C0140 Ergonomic aspects of control and robotics C3360B Road-traffic system control C3390C Mobile robots C7445 Traffic engineering computing C7475 Automotive computing
DI	January 2025

biochar

BT	renewable materials
RT	agriculture bioremediation biotechnology charcoal environmental factors fertilisers organic compounds pyrolysis soil wastewater treatment
CC	E1710 Engineering materials
DI	January 2025

bioremediation

BT	contaminated site remediation decontamination
RT	biochar biodegradable materials biotechnology microorganisms sludge treatment soil pollution toxicology wastewater treatment water pollution
CC	A8675F Contamination remediation (environmental science technology) B0170Q Environmental factors E0230 Environmental issues
DI	January 2025

chalcogenide semiconductors

BT	semiconductor materials
NT	chalcogenide glasses transition metal dichalcogenides
RT	II-VI semiconductors ternary semiconductors
PT	semiconductor materials
CC	A7280 Electrical conductivity of specific semiconductors and insulators A7315 Electronic structure: density of states and band structure (thin films, low-dimensional and nanoscale structures) A7360 Electrical properties of thin films, low-dimensional and nanoscale structures A7865 Optical properties of thin films, low-dimensional and nanoscale structures B2520H III-VI and IV-VI semiconductors B2520K Ternary and quaternary semiconductors B2520M Other semiconductor materials
DI	January 2025

community detection (network theory)

BT	network theory (graphs)
RT	complex networks graph theory machine learning pattern clustering social network theory social networking (online)
PT	network theory (graphs)
CC	A0210 Algebra, set theory, and graph theory B0250 Combinatorial mathematics C1160 Combinatorial mathematics C1290P Systems theory applications in social science and politics E0210E Combinatorial mathematics E1540 Systems theory applications
DI	January 2025

computer performance evaluation *[promoted lead-in]*

BT	performance evaluation
RT	benchmark testing computer evaluation computer network performance evaluation computer purchase computer selection computer testing DP management fault tolerant computing power aware computing
PT	performance evaluation
CC	C0310H Computer equipment and software evaluation methods C5470 Performance evaluation and testing
DI	January 2025

cosine similarity

UF	similarity measure
BT	data analysis vectors
RT	data mining feature extraction information retrieval machine learning natural language processing nearest neighbour methods text analysis
PT	data analysis
CC	A0210 Algebra, set theory, and graph theory B0210 Algebra C1110 Algebra C6130 Data handling techniques E0210A Algebra
DI	January 2025

covalent organic frameworks

BT	polymers porous materials
RT	polymer structure porosity
PT	polymers
CC	A6140G Structure of powders and porous materials A6140K Structure of polymers, elastomers, and plastics A8120S Preparation of organic materials, polymers and plastics
DI	January 2025

dehydrogenation

BT	chemical reactions
RT	catalysis hydrogen hydrogen storage hydrogenation
PT	chemical reactions
CC	A8230 Specific chemical reactions; reaction mechanisms A8265 Surface chemistry A8640K Hydrogen storage and technology
DI	January 2025

feature fusion

BT	data fusion feature extraction
RT	feature selection image classification image fusion machine learning neural nets object detection sensor fusion
PT	data fusion feature extraction
CC	B6135 Optical, image and video signal processing C5260B Computer vision and image processing techniques C6130 Data handling techniques
DI	January 2025

galactic mass

RT	galaxies
PT	galaxies
CC	A9850F Masses of galaxies
DI	January 2025

generative adversarial networks *[promoted lead-in]*

UF	GAN (neural nets)
BT	adversarial neural nets generative AI
RT	convolutional neural nets feature extraction image classification image reconstruction image resolution image segmentation large language models medical image processing pattern classification unsupervised learning
PT	neural nets
CC	B1295 Neural nets (circuit implementations) C1230D Neural nets (theory) C1230L Learning in AI (theory) C5190 Neural nets (circuit implementations) C6264G Generative AI (inc. generative adversarial networks)
DI	January 2025

generative AI

UF	GAI
	generative artificial intelligence
	image generation (AI)
	image synthesis (AI)
BT	deep learning (artificial intelligence)
NT	generative adversarial networks
	large language models
RT	adversarial neural nets
	chatbots
	computer crime
	convolutional neural nets
	data augmentation
	ethical aspects
	fake news
	human computer interaction
	image forensics
	image processing
	natural language processing
	politics
	recurrent neural nets
	reinforcement learning
	supervised learning
	text analysis
	transformers (machine learning)
	unsupervised learning
PT	artificial intelligence
CC	C1230D Neural nets (theory)
	C1230L Learning in AI (theory)
	C6264G Generative AI (inc. generative adversarial networks)
DI	January 2025

gradient boosting *[promoted lead-in]*

UF	gradient tree boosting
BT	ensemble learning
	gradient methods
	supervised learning
RT	decision trees
	deep learning (artificial intelligence)
	feature extraction
	neural nets
	pattern classification
	regression analysis
	support vector machines
PT	gradient methods
	supervised learning
CC	A0260 Numerical approximation and analysis
	B0260 Optimisation techniques
	B0290F Interpolation and function approximation (numerical analysis)
	B0290H Linear algebra (numerical analysis)
	C1180 Optimisation techniques
	C1230L Learning in AI (theory)
	C1240 Adaptive system theory
	C4130 Interpolation and function approximation (numerical analysis)
	C4140 Linear algebra (numerical analysis)
	C6261 Supervised learning
	E0210G Optimisation
	E0210L Numerical analysis
DI	January 2025

homomorphic encryption

UF	homomorphic cryptosystems
	homomorphic secret sharing
BT	cryptography
RT	cloud computing
	data analysis
	data privacy
	public key cryptography
PT	cryptography
CC	B6120D Cryptography
	C1260C Cryptography theory
	C5480 Security aspects of hardware
	C6130S Data security
DI	January 2025

hydroxyapatite *[promoted lead-in]*

BT calcium compounds
 RT biomedical materials
 PT calcium compounds
 CC A8100 Materials science
 A8770M Biomedical materials
 DI January 2025

Kalman filters (signal processing)

UF extended Kalman filters
 unscented Kalman filters
 BT filters
 NT adaptive Kalman filters
 RT adaptive filters
 filtering theory
 H₂ filters
 H_∞ filters
 information theory
 SLAM (robots)
 soft sensors
 time-varying filters
 tracking filters
 PT Kalman filters
 CC B1270 Filters and other networks
 B6140B Filtering methods in signal
 processing
 C1260S Signal processing theory
 C5260 Digital signal processing
 DI January 2025

Kalman filters (state estimation)

UF extended Kalman filters
 unscented Kalman filters
 BT filters
 state estimation
 NT adaptive Kalman filters
 RT estimation theory
 observability
 PT Kalman filters
 parameter estimation
 state estimation
 CC C1220 Simulation, modelling and
 identification
 DI January 2025

knowledge graphs *[promoted lead-in]*

UF graph-based data modelling
 BT graph theory
 ontologies (artificial intelligence)
 semantic networks
 RT data mining
 formal languages
 inference mechanisms
 information retrieval
 natural language processing
 query processing
 representation learning
 text analysis
 PT semantic networks
 CC A0210 Algebra, set theory, and
 graph theory
 B0250 Combinatorial mathematics
 C1160 Combinatorial mathematics
 C1230 Artificial intelligence
 (theory)
 C6130 Data handling techniques
 C6230 Knowledge representation
 E0210E Combinatorial mathematics
 DI January 2025

large language models

UF	BERT (natural language processing) bidirectional encoder representations from transformers chat generative pre-trained transformer ChatGPT LLM text generation (AI)
BT	generative AI natural language processing transformers (machine learning)
RT	chatbots feature extraction generative adversarial networks pattern classification question answering (information retrieval) speech recognition text analysis
PT	deep learning (artificial intelligence) natural language processing
CC	C1230D Neural nets (theory) C1230L Learning in AI (theory) C6264G Generative AI (inc. generative adversarial networks) C6264T Transformers (neural nets) C7820N Natural language processing
DI	January 2025

laser powder bed fusion

UF	selective laser melting
BT	laser materials processing powder technology three-dimensional printing
PT	laser materials processing powder technology
CC	A4262A Laser materials processing A8120E Powder techniques, compaction and sintering B0580 Powders and porous materials (engineering materials science) B4360B Laser materials processing E1520J Powder technology
DI	January 2025

machine learning

[promoted lead-in]

UF	AdaBoost Adaptive Boosting attention mechanisms continual learning (artificial intelligence) few shot learning hyperparameter optimisation hyperparameter optimization hyperparameter tuning hyperparameters incremental learning knowledge distillation (artificial intelligence) learning (artificial intelligence) meta-learning model aggregation (AI) neural net training robot learning rule generation training (neural nets)
BT	artificial intelligence
NT	adversarial machine learning backpropagation deep learning (artificial intelligence) ensemble learning federated learning Hebbian learning learning by example naive Bayes methods nearest neighbour methods random forests reinforcement learning representation learning semi-supervised learning (artificial intelligence) supervised learning transfer learning (artificial intelligence) unsupervised learning
RT	adaptive resonance theory AI chips Boltzmann machines chatbots community detection (network theory) conditional random fields cosine similarity data augmentation data preparation data science decision trees explainable AI fake news feature fusion feature selection

	feedforward neural nets		nanochannel flow
	fuzzy cognitive maps	BT	channel flow
	granular computing		nanofluidics
	Hopfield neural nets	RT	nanofluids
	human activity recognition		pipe flow
	image annotation		Poiseuille flow
	independent component analysis	PT	channel flow
	k-means algorithms		nanofluidics
	learning automata	CC	A4760 Flows in ducts, channels, and conduits
	learning systems		A4785 Applied fluid mechanics
	linear discriminant analysis		A4787 Microfluidics and nanofluidics
	logistic regression		E2130 Fluid mechanics and aerodynamics (mechanical engineering)
	multilayer perceptrons		E2160 Micromechanics (mechanical engineering)
	neurocontrollers	DI	January 2025
	perceptrons		
	radial basis function networks		
	recurrent neural nets		
	self-organising feature maps		
	social robots		
	soft sensors		
	support vector machines		
PT	learning (artificial intelligence)		
CC	C1230L Learning in AI (theory)		
	C1240 Adaptive system theory		
	C6260 Machine learning (artificial intelligence)		
	C6261 Supervised learning	PT	nanostructured materials
	C6262 Unsupervised learning	CC	A6146 Structure of quantum and nanomaterials (inc. nanoparticles, nanotubes, nanowires, quantum dots, quantum wires and quantum wells)
	C6263 Reinforcement learning		A7315 Electronic structure: density of states and band structure (thin films, low-dimensional and nanoscale structures)
	C6264 Neural nets		A7360 Electrical properties of thin films, low-dimensional and nanoscale structures
DI	January 2025		A7865 Optical properties of thin films, low-dimensional and nanoscale structures
			A8116 Methods of nanofabrication and processing
			B2530C Semiconductor superlattices, quantum wells and related structures
			B2550N Nanometre-scale semiconductor fabrication technology
		DI	January 2025
	microwave radiation effects		
BT	radiation effects		
NT	biological effects of microwaves		
PT	microwave spectra		
	radiation effects		
CC	A6180 Radiation damage and other irradiation effects		
	A7870G Microwave, radiofrequency and terahertz wave interactions with condensed matter		
	B2550R Radiation effects (semiconductor technology)		
DI	January 2025		

nanofluids

BT	nanofluids
RT	colloids
	heat transfer
	nanochannel flow
	nanofluidics
	nanoparticles
	suspensions
	two-phase flow
PT	nanofluids
CC	A4785 Applied fluid mechanics
	A4787 Microfluidics and nanofluidics
	A6146 Structure of quantum and nanomaterials (inc. nanoparticles, nanotubes, nanowires, quantum dots, quantum wires and quantum wells)
	E2130 Fluid mechanics and aerodynamics (mechanical engineering)
	E2160 Micromechanics (mechanical engineering)
DI	January 2025

nanofluids

BT	nanofluids
	superconducting materials
RT	nanotechnology
	superconductivity
PT	nanofluids
	superconducting materials
CC	A6146 Structure of quantum and nanomaterials (inc. nanoparticles, nanotubes, nanowires, quantum dots, quantum wires and quantum wells)
	A7360 Electrical properties of thin films, low-dimensional and nanoscale structures
	A7470 Superconducting materials
	A8116 Methods of nanofabrication and processing
	B3220 Superconducting materials
	E1520P Nanofabrication
	E3644T Nanotechnology industry
DI	January 2025

optical phonons

BT	phonons
PT	phonons
CC	A6320 Phonons and vibrations in crystal lattices
	A6322 Phonons in low-dimensional structures and small particles
	A7430K Phonons in superconductors
	A7820 Optical properties of condensed matter
DI	January 2025

photodegradation

BT	photochemistry
RT	dyes
	laser beam effects
	pharmaceuticals
	photocatalysis
	ultraviolet radiation effects
	visible light radiation effects
	wastewater treatment
	water pollution control
	water treatment
PT	photochemistry
CC	A8250F Photodegradation, photolysis and photodissociation by IR, UV and visible radiation
DI	January 2025

physical unclonable functions

UF	PUF (physically unclonable functions)
RT	cryptographic protocols
	cryptography
	digital signatures
	Internet of Things
	monolithic integrated circuits
	security of hardware
PT	cryptography
CC	B6120D Cryptography
	C1260C Cryptography theory
	C5480 Security aspects of hardware
	C6130S Data security
DI	January 2025

polygeneration

BT electric power generation
 NT cogeneration
 trigeneration
 RT direct energy conversion
 energy Internet
 exergy
 heating
 hydrogen production
 power generation economics
 PT electric power generation
 CC B8120K Distributed power generation
 B8200 Generating stations and plants
 DI January 2025

precision agriculture

BT agriculture
 RT agricultural computing
 agricultural machinery
 agricultural robots
 artificial intelligence
 autonomous aerial vehicles
 crops
 Global Positioning System
 image classification
 Internet of Things
 mobile robots
 remote sensing
 wireless sensor networks
 CC C1290B Systems theory applications
 in natural resources and ecology
 C3310C Control applications in
 agriculture
 C3390C Mobile robots
 C7860 Agriculture, forestry and
 fisheries computing
 E0410 Information technology
 applications
 E3010 Agriculture
 DI January 2025

primary education

UF elementary school education
 first school education
 junior school education
 middle school education
 BT education
 RT blended learning
 computer aided instruction
 distance learning
 educational courses
 educational institutions
 STEM
 teaching
 PT education
 CC A0140 Education
 B0120 Education and training
 C0110 Control education and training
 C0220 Computing education and
 training
 C1290J Systems theory applications
 in education
 E0250 Education and training
 DI January 2025

public safety

UF personal safety
 BT safety
 RT accident prevention
 aerospace safety
 alarm systems
 autonomous driving
 closed circuit television
 computer crime
 data privacy
 disasters
 diseases
 domestic safety
 electrical safety
 emergency management
 emergency services
 epidemics
 fake news
 fire safety
 fission reactor safety
 food safety
 government policies
 health and safety
 health care
 marine safety
 mobile computing
 national security
 police
 pollution
 public administration
 road safety
 safety devices
 sensors
 smart cities
 terrorism
 video surveillance
 PT safety
 DI January 2025

representation learning *[promoted lead-in]*

UF feature learning
 BT knowledge representation
 machine learning
 RT convolutional neural nets
 deep learning (artificial intelligence)
 feature extraction
 graph theory
 image representation
 knowledge graphs
 neural nets
 supervised learning
 unsupervised learning
 PT knowledge representation
 learning (artificial intelligence)
 CC C1230L Learning in AI (theory)
 C6230 Knowledge representation
 C6260 Machine learning (artificial intelligence)
 DI January 2025

secondary education

UF high school education
 BT education
 RT blended learning
 computer aided instruction
 distance learning
 educational courses
 educational institutions
 STEM
 teaching
 PT education
 CC A0140 Education
 B0120 Education and training
 C0110 Control education and training
 C0220 Computing education and training
 C1290J Systems theory applications in education
 E0250 Education and training
 DI January 2025

shape memory polymers

BT	polymers shape memory effects
RT	intelligent materials martensitic transformations plastic deformation thermoelasticity thermomechanical effects
PT	polymers shape memory effects
CC	A6140K Structure of polymers, elastomers, and plastics A6220F Deformation and plasticity A6470K Solid-solid transitions A8130K Martensitic transformations A8140L Deformation, plasticity and creep B0560 Polymers and plastics (engineering materials science) E1710 Engineering materials E2000 Engineering mechanics E2180B Plasticity (mechanical engineering)
DI	January 2025

single photon detectors

BT	optical sensors photodetectors
RT	photon counting
PT	photodetectors
CC	A0760 Optical instruments and techniques A0762 Detection of radiation (bolometers, photoelectric cells, i.r. and submillimetre waves detection) A4250 Quantum optics B7230 Sensing devices and transducers
DI	January 2025

sonochemistry

BT	chemical reactions materials preparation ultrasonic effects
RT	food processing industry food technology ultrasonic applications wastewater treatment water pollution control water treatment
PT	chemical reactions materials preparation
CC	A8120 Other methods of preparation of materials A8230 Specific chemical reactions; reaction mechanisms E1525Z Other Industrial processes E3626 Chemical industry
DI	January 2025

surface patterning

BT	surface treatment
NT	nanopatterning
RT	photolithography soft lithography surface structure
PT	surface treatment
CC	A8160 Corrosion, oxidation, etching, and other surface treatments B2550 Semiconductor technology E1520N Surface treatment and coating techniques
DI	January 2025

tensile deformation

UF	tensile strain
BT	deformation
RT	elastic deformation
	necking
	plastic deformation
	shear deformation
	tensile strength
PT	deformation
CC	A0340 Classical mechanics of continuous media: general mathematical aspects
	A4630J Viscoelasticity, plasticity, viscoplasticity, creep, and stress relaxation
	A6220F Deformation and plasticity
	A8140L Deformation, plasticity and creep
	E2180 Specific mechanical properties (mechanical engineering)
DI	January 2025

thermally activated delayed fluorescence

UF	TADF
BT	fluorescence
RT	light emitting diodes
PT	fluorescence
CC	A7860K Thermoluminescence (condensed matter)
	B4220 Luminescent materials
DI	January 2025

time-domain spectra

BT	spectra
RT	time resolved spectra
PT	spectra
CC	A3580B Time-resolved measurements and techniques (atoms and molecules)
	A4280W Ultrafast optical techniques
	A7847 Ultrafast optical measurements in condensed matter
DI	January 2025

time-domain spectroscopy

BT	spectroscopy
RT	high-speed optical techniques
	time resolved spectroscopy
	time-domain reflectometry
PT	spectroscopy
CC	A0765 Optical spectroscopy and spectrometers
	A3580B Time-resolved measurements and techniques (atoms and molecules)
	A4280W Ultrafast optical techniques
DI	January 2025

transformers (machine learning) [promoted lead-in]

UF	vision transformers
BT	deep learning (artificial intelligence)
NT	large language models
RT	computer vision
	convolutional neural nets
	feature extraction
	generative AI
	image classification
	image segmentation
	medical image processing
	natural language processing
	object detection
	pattern classification
	text analysis
PT	deep learning (artificial intelligence)
CC	B1295 Neural nets (circuit implementations)
	C1230D Neural nets (theory)
	C1230L Learning in AI (theory)
	C5190 Neural nets (circuit implementations)
	C6264T Transformers (neural nets)
DI	January 2025

variational mode decomposition

UF	VMD (variational mode decomposition)
BT	signal processing
RT	fault diagnosis
	feature extraction
	power engineering computing
	vibrational signal processing
PT	signal processing
CC	B6140 Signal processing and detection
	C1260S Signal processing theory
	C5260 Digital signal processing
DI	January 2025

yttria-stabilised zirconia

UF	YSZ
	yttria-stabilized zirconia
BT	yttrium compounds
	zirconium compounds
PT	yttrium compounds
	zirconium compounds
DI	January 2025