NED UNIVERSITY OF ENGINEERING & TECHNOLOGY
E-Mail:dracad@neduet.edu.pk/Website:http://www.neduet.edu.pk
Phone: (92-21) 99261261-8 Ext-2221/Fax: (92-21) 99261255

No.Acad/27(195)/52408 **Dated: 25-06-2025**

NOTIFICATION

In pursuance to powers delegated to the Academic Council by Syndicate vide its Resolution No. SYN-186.4(b) dated 26-10-2018, it is hereby notified that the Academic Council vide its Resolution No. AC-168.6(iii) dated 26-05-2025 has approved the revised Scheme of Studies & Courses along-with Course Dependency Chart for Bachelor of Metallurgical Engineering Programme by the Department of Metallurgical Engineering; applicable from Batch-2025.

One copy of the aforesaid approved revised Scheme of Studies is enclosed as **Annex: A**.

REGISTRAR

Encl: as above

To,
Chairperson, Department of Metallurgical Engineering

Copy to:-

1- Dean (CPE)
2- Controller of Examinations
3- Director, I.T. Department
4- Assistant Registrar (Academic)

Copy for information to:-

1- PS to the Vice Chancellor
2- PA to Pro-Vice Chancellor
3- Director QEC

Annex: A

Scheme of Studies
(Applicable from 2025 Batch and Onward)

First Year (FE - MYD)

Fall Semester						Spring Semester					
S#	Course Code	Course Title	Credit Hours			S#	Course Code	Course Title	Credit Hours		
			Th	Pr	Total				Th	Pr	Total
1	**MY-102**	**Introduction to Metallurgical Engineering**	**2**	**0**	**2**	1	EA-128	Functional English	3	0	3
2	ES-108	Ideology and Constitution of Pakistan	2	0	2	2	ES-105/ES-127	Pakistan Studies / Pakistan Studies For Foreigners	2	0	2
3	CY-110	Applied Chemistry for Engineers	2	1	3	3	AU-112	Engineering Drawing and Computer Graphics	2	1	3
4	MT-116	Calculus & Analytical Geometry	3	0	3	**4**	**PF-101**	**IT Fundamentals and Application**	**2**	**1**	**3**
5	EE-124	Basic Electricity and Electronics	2	1	3	5	ES-206/ES-209	Islamic Studies / Ethical Behavior	2	0	2
6	ME-101	Engineering Mechanics	3	1	4	6	MT-221	Linear Algebra & Ordinary Differential Equations	3	0	3
7	CY-100	Essentials of Chemistry (for Computer Science Students Only)	NC Course			-			-	-	-
		Total	14	3	17			**Total**	**14**	**2**	**16**
								Total Credit Hours in FE			**33**

Second Year (SE - MYD)

Fall Semester						Spring Semester					
S#	Course Code	Course Title	Credit Hours			S#	Course Code	Course Title	Credit Hours		
			Th	Pr	Total				Th	Pr	Total
1	MT-441	Advanced Mathematical Techniques	3	0	3	1	MY-210	Iron Making Processes	2	0	2
2	MY-211	Metallurgical Thermodynamics and Kinetics	3	0	3	2	MM-303	Inspection and Testing of Materials	3	1	4
3	**MY-212**	**Physical Metallurgy**	**3**	**1**	**4**	**3**	**MY-214**	**Metal Forming and Shaping Processes**	**3**	**1**	**4**
4	**MY-213**	**Instrumentation and Control**	**2**	**0**	**2**	**4**	**MY-215**	**Engineering Ceramics and Refractories**	**2**	**0**	**2**
5	**PF-201**	**Civics and Community Engagement**	**2**	**0**	**2**	5	MT-331	Probability and Statistics	3	0	3
6	**ME-228**	**Workshop Practice**	**0**	**1**	**1**	6	MY-208	Mineral Processing	2	1	3
7	MY-207	Mechanical Behavior of Materials	2	1	3	7	PF-205	Community Service	NC Course		
		Total	**15**	**3**	**18**			**Total**	**15**	**3**	**18**
								Total Credit Hours in SE			**36**

Third Year (TE - MYD)											
Fall Semester						**Spring Semester**					
S#	**Course Code**	**Course Title**	**Credit Hours**			**S#**	**Course Code**	**Course Title**	**Credit Hours**		
			Th	**Pr**	**Total**				**Th**	**Pr**	**Total**
1	EA-304	Business Communication and Ethics	3	0	3	1	MY-304	Metallurgy of Welding	2	1	3
2	MY- 308	Polymer and Composite Materials	2	1	3	2	MY-310	Non-Ferrous Extractive Metallurgy	3	0	3
3	MY-309	Steel Making Processes	2	0	2	**3**	**PF-301**	**Professional Ethics**	**2**	**0**	**2**
4	MY-303	Foundry: Principles, Methods and Practices	3	1	4	4	MM-304	Heat Treatment of Materials	3	1	4
5	**MY-311**	**Machine Learning in Metallurgical Engineering**	**2**	**1**	**3**	5	XX-###	Social Science Elective	2	0	2
6	**PF-401**	**Entrepreneurship**	**2**	**0**	**2**	6	MY- 412	Metallurgy of Advanced Steels	2	0	2
		-	-	-	-	7	EA/ES###	Foreign Language-I	0	0	0
		Total	**14**	**3**	**17**			**Total**	**14**	**2**	**16**
								Total Credit Hours in TE			**33**

Final Year (BE - MYD)											
Fall Semester						**Spring Semester**					
S#	**Course Code**	**Course Title**	**Credit Hours**			**S#**	**Course Code**	**Course Title**	**Credit Hours**		
			Th	**Pr**	**Total**				**Th**	**Pr**	**Total**
1	**MY-415**	**Design, Selection and Characterization of Engineering Materials**	**3**	**1**	**4**	1	MY-413	Corrosion Engineering	2	1	3
2	XX-###	Management Sciences-Elective	2	0	2	2	MY-406	Powder Metallurgy	2	1	3
3	MY-410	Fracture Mechanics and Failure Analysis	2	1	3	**3**	**MY-417**	**Computational Materials Science**	**1**	**2**	**3**
4	**MY-416**	**Health, Safety & Environment**	**1**	**0**	**1**	4	MY-408	Metallurgical Engineering Design Project	0	3	3
5	MY-408	Metallurgical Engineering Design Project	0	3	3	5	XX-###	Technical Elective 3	2	0	2
6	EA/ES###	Foreign Language-II	0	0	0	6	XX-###	Technical Elective 4	2	0	2
7	XX-###	Technical Elective 1	2	0	2	-	-	-	-	-	-
8	XX-###	Technical Elective 2	2	0	2	-	-	-	-	-	-
		Total	**12**	**5**	**17**			**Total**	**9**	**7**	**16**
								Total Credit Hours in BE			**33**
								Total Credit Hours in the BE Programme			**135**

Social Sciences Electives					
1	EA-321	Logic & Critical Thinking	2	0	2
2	MG-228	Sociology and Development	2	0	2
3	MG-257	Organizational Behavior	2	0	2
4	ME-433	Law for Engineers	2	0	2
Management Sciences Electives					
1	MG-483	Supply Chain Management	2	0	2
2	ME-434	Total Quality Management	2	0	2
3	PF-206	Engineering Economics and Management	2	0	2
Technical Elective 1					
1	**MY-418**	**Advanced Materials**	2	0	2
2	**MY-419**	**High-Temperature Metals and Alloys**	2	0	2
3	**MY-420**	**Nanotechnology**	2	0	2
4	**MY-421**	**Fundamentals of Biomaterials**	2	0	2
5	**MY-422**	**Electronic, Magnetic, and Optical Materials**	2	0	2
Technical Elective 2					
1	**MY-423**	**Thin Films and Coating Techniques**	2	0	2
2	**MY-424**	**Surface Engineering**	2	0	2
3	**MY-425**	**Additive Manufacturing**	2	0	2
Technical Elective 3					
1	**MY-426**	**Phase Transformations in Metals and Alloys**	2	0	2
2	**MY-427**	**Metallurgical Plants and Quality Control**	2	0	2
3	MY-411	Vacuum Metallurgy	2	0	2
Technical Elective 4					
1	**MY-428**	**Nuclear Metallurgy**	2	0	2
2	MM-309	Construction Materials	2	0	2
3	**MY-429**	**Oilfield Metallurgy**	2	0	2

Foreign Language-I	
Course Code	**Course Title**
EA-220	Chinese Language-I
EA-231	Turkish Language-I
EA-224	German Language-I
EA-226	French Language-I
ES-222	Arabic Language-I
EA-233	Japanese Language-I
EA-235	Russian Language-I
Foreign Language-II	
Course Code	**Course Title**
EA-221	Chinese Language-II
EA-232	Turkish Language-II
EA-225	German Language-II
EA-227	French Language-II
ES-223	Arabic Language-II
EA-234	Japanese Language-II
EA-236	Russian Language-II

F/QSP 07/05/01

NED University of Engineering and Technology
COURSE DESIGN FORM
MY- 102 Introduction to Metallurgical Engineering

EXISTING				APPROVED				✓New Course • Revised Course ✓Compulsory Course • Elective Course
				MY-102: Introduction to Metallurgical Engineering				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	Applicable from **Batch 2025**
Th.	**0**	**0**	**0**	**Th.**	**2**	**2**	**100**	
Pr.	**0**	**0**	**0**	**Pr.**	**0**	**0**	**0**	REMARKS
				Introduction to Metallurgy: Definition, scope, and importance, overview of materials: metals, ceramics, polymers, and composites, historical development, and current trends. Classification of Metallurgy. Structure of Metals: Atomic structure, crystal structures (BCC, FCC, HCP), crystallographic planes and directions, crystal imperfections and dislocations. Properties of Metals and alloys. Introduction to Phase Diagrams. Corrosion and Degradation: Basic corrosion mechanisms, Corrosion prevention methods, and environmental degradation. Foundry and Forming Techniques: Introduction to casting, forging, rolling, types of molds, and casting defects. Overview of Characterization Techniques: Optical microscopy, SEM, XRD, and Microstructure-property relationship.				**Course adopted with revised content in place of MY-101 and credit hours reduced as per PEC/ECRD guidelines**

Recommended book(s) for the proposed course
(Author's name, "Title", edition, publisher, publication year).

Textbook(s)

1. William D. Callister, Jr. and David G. Rethwisch, *"Materials Science and Engineering: An Introduction"*, 10th edition, Wiley, 2020.
2. Alan Cottrell, *"An Introduction to Metallurgy"*, 2nd edition, CRC Press, 2019.

Reference Book(s)

1. G*eorge E. Dieter, "Introduction to metallurgical Engineering*", 3rd edition McGraw-Hill, 1986.
2. Joseph R. Davis, *"Metals Handbook Desk Edition"*, 2nd edition, ASM International, 1998.

Other Equivalent Courses
(offered in this University)

F/QSP 07/05/01

NED University of Engineering and Technology
COURSE DESIGN FORM
MY-212 Physical Metallurgy

EXISTING				APPROVED				✓New Course •Revised Course ✓Compulsory Course •Elective Course Applicable from **Batch 2025**
				MY-212 Physical Metallurgy				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th.	**0**	**0**	**0**	**Th.**	**3**	**3**	**100**	
Pr.	**0**	**0**	**0**	**Pr.**	**1**	**3**	**50**	REMARKS
				Crystal structure of materials, Space lattice, Crystal system, Unit cell, Packing density, Coordination number, Allotropy, Solidification (Homogeneous and heterogeneous); Nucleation and growth; Grain-boundaries and grain structure; Cast structure, Segregation, Shrinkage defects; Diffusion in solids. Phase-rule; Solid solutions; Interstitial solid solution and Substitutional solid solution; limits of solid solubility; Solid state transformations; Phase transformations in metals; types of Compounds; different types of binary phase diagrams: Isomorphous system, Eutectic and eutectoid reactions, coherent/in-coherent precipitates, Peritectic and peritectoid reactions; Ordered and disordered solutions; Iron-Iron carbide system, Role of Metallurgical microscope in the analysis of microstructure; theory of etching and concept of grain boundary energy. Heat-treatment of steels, phase transformations in steels; microstructure and properties of plain carbon steels and cast-irons; microstructure of common copper-base and aluminum-base alloys.			**Adopted in place of MM-201.**

Recommended book(s) for the proposed course
(Author's name, "Title", edition, publisher, publication year).

Textbook(s)

1. V. M. Schastlivtsev and V. I. Zel'dovich, "Physical Metallurgy: Metals, Alloys, Phase Transformations", De Gruyter GmbH, 2022.
2. D. G. Rethwisch and W. D. Callister Jr., "Materials Science and Engineering: An Introduction", 10th edition, Wiley, 2018.

Reference Book(s)

1. Sidney H. Avner, "Introduction to Physical metallurgy", 2nd edition McGraw-Hill, 1974.
2. G. N. Haidemenopoulos, "Physical Metallurgy: Principles and Design", 1st edition, CRC Press, 2018

Other Equivalent Courses
(offered in this University)

F/QSP 07/05/01

NED University of Engineering and Technology
COURSE DESIGN FORM
MY-213 Instrumentation and Control

EXISTING				APPROVED				✓New Course •Revised Course ✓Compulsory Course •Elective Course Applicable from **Batch 2025**
				MY-213 Instrumentation and Control				
	Cr. Hrs	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th.	**0**	**0**	**0**	**Th.**	**2**	**2**	**100**	
Pr.	**0**	**0**	**0**	**Pr.**	**0**	**0**	**0**	REMARKS
N.A				Basic Concepts about Instrumentation and Process Control. Pressure Measurement: Pressure units, Manometers, Diaphragms, Bellows, Bourdon Tubes, and Secondary Transducers (strain gauge and LVDT). Temperature Measurement: Introduction and units. Liquid Expansion. hermometers (Mercury in Glass, Liquid in glass), Bimetallic strip Thermometers, Pressure-Spring thermometers, Resistance Temperature Detectors, thermistors, Thermocouples. Pyrometers. Level Measurement: Differential Pressure, Displacer, Bubbler, Capacitance, Conductance, Ultrasonic, Flow Measurement: Head-type flow meters (Orifice plate, Venturi tube, pilot tube), Rotameter, Anemometers, Electromagnetic flow meters, Mechanical Meter (turbine type), Ultrasonic type flowmeter. Weight, Force, stress, and strain measurement. Introduction to process control: Process Control, Definitions of the Elements in a Control Loop, Units and Standards, Instrument Parameters, Control types.			**Adopted as per ECRDC/PEC guideline**

Recommended book(s) for the proposed course
(Author's name, "Title", edition, publisher, publication year).

Textbook(s)

1. W. Bolton, *"Instrumentation and Control Systems"*, 3rd edition, Newnes, 2021.
2. W. C. Dunn, *"Fundamentals of Industrial Instrumentation and Process Control"*, 2nd edition, McGraw Hill Professional, 2018.

Reference Book(s)

1 C. D. Johnson, *"Process Control Instrumentation Technology"*, Pearson/Prentice Hall, 2006.

2 D. Patranabis**,** *"Principles of Industrial Instrumentation", 2nd Edition,* , McGraw Hill, 2008.

Other Equivalent Courses
(offered in this University)

NED University of Engineering and Technology
COURSE DESIGN FORM
MY- 214 Metal Forming and Shaping Processes

F/QSP 07/05/01

EXISTING				APPROVED				• New Course ✓Revised Course ✓Compulsory Course • Elective Course Applicable from **Batch 2025**
MY-209 Metal Forming and Shaping Processes				**MY-214 Metal Forming and Shaping Processes**				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th.	**2**	**2**	**100**	**Th.**	**3**	**3**	**100**	
Pr.	**1**	**3**	**50**	**Pr.**	**1**	**3**	**50**	REMARKS
Introduction: Metal Shaping Processes, their classification and Structure-Property-Processing Relationship. Theory of plasticity: Material behavior under forming conditions, Stress and strain, Macroscopic plasticity and yield criteria, Work Hardening, Plastic instability, Ideal work, friction, redundant work, and mechanical efficiency, Flow stress, deformation resistance, Strain rate and temperature dependence of flow stress, workability, evolution of microstructure during metal working, Friction and surface integrity, Formability, bending, Plastic anisotropy. ~~Analysis of Metal Forming Processes: Slab analysis, upper bound analysis, Slip-line field theory, and deformation zone geometry~~, Study of Forging, Rolling, Extrusion, Wire, Rod, Tube and Sheet Metal Forming Processes. Design of Metal working Equipment: Fundamentals of design of metal forming equipment such as: Forging presses, Rolling Mills and accessories, and extrusion equipment Applications: ~~FEM based simulation of metal forming processes~~				Introduction: Metal Shaping Processes, their classification and Structure-Property-Processing Relationship. Theory of plasticity: Material behavior under forming conditions, Stress and strain, Macroscopic plasticity and yield criteria, Work Hardening, Plastic instability, Ideal work, friction, redundant work, and mechanical efficiency, Flow stress, deformation resistance, Strain rate and temperature dependence of flow stress, workability, evolution of microstructure during metal working, Friction and surface integrity, Formability, bending, Plastic anisotropy. Principles of metal forming processes, **softening and hardening mechanisms, metal-working in the re-crystallization rolling process and equipment, forces in rolling, metal flow, defects and their prevention, and numerical methods related to the rolling process. Forging, process and equipment, Forces in Forging, grain flow, forging defects and their prevention, numerical methods related to the forging process. Extrusion, Processes and equipment, extrusion defects, numerical related to the extrusion process. Wire-drawing. Sheet-metal working, stretch forming, deep drawing, continuous roll forming, Wire, Rod, Tube, and Sheet Metal Forming Processes(cutting methods, forming operations), their mechanics and testing methods, numerical methods related to sheet metal working process.** Design of Metalworking Equipment: Fundamentals of design of metal forming equipment, such as: Forging presses, Rolling Mills, and accessories.				**Credit hours changed from 2 to 3 hrs., and the course contents are also updated.**

Recommended book(s) for the proposed course
(Author's name, "Title", edition, publisher, publication year).

Textbook(s)

1. Serope Kalpakjian and Steven R. Schmid, *"Manufacturing Processes for Engineering Materials"*, 6th edition, Pearson, 2021.
2. Mikell P. Groover, *"Introduction to Manufacturing Processes"*, 1st edition, Wiley, 2011.

Reference Book(s)

1. R. H. Wagoner & Jean-Loup Chenot, *"Fundamentals of Metal Forming"*, 1st edition, Wiley, 1996.
2. George E. Dieter, *"Mechanical Metallurgy"*, SI metric edition, McGraw Hill, 2002.

Other Equivalent Courses
(offered in this University)

F/QSP 07/05/01

NED University of Engineering and Technology
COURSE DESIGN FORM
MY- 215 Engineering Ceramics and Refractories

EXISTING				APPROVED				✓New Course •Revised Course ✓Compulsory Course •Elective Course Applicable from **Batch 2025**
				MY-215 Engineering Ceramics and Refractories				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th.	**0**	**0**	**0**	**Th.**	**2**	**2**	**100**	
Pr.	**0**	**0**	**0**	**Pr.**	**0**	**0**	**0**	REMARKS
				Definition and classification of ceramics, Types and classification of engineering ceramics. Common ceramic materials (oxides, carbides, nitrides, borides). Applications of engineering ceramics. Atomic structure and bonding (ionic, covalent), Crystalline and amorphous ceramics. Silica and silicate structures, mullite and spinels, glass and glass processing, glass ceramics. Fracture toughness, micro crack formation, and high temperature application of ceramics, processing of ceramics, shaping and binding, molding, firing, sintering. Thermal conductivity and thermal expansion, Thermal shock resistance, Electrical properties (dielectric, piezoelectric, and superconducting ceramics), Ceramic matrix composites (CMC), Bioceramics and biomedical applications, Magnetic ceramics. Refractories: Raw materials for refectories such as fire clay, china clay, silica materials, alumina, magnesite, dolomite, chromite, graphite, carbon materials, Zirconia, classification of refractories. Manufacturing, testing, and use of basic, neutral, acid, and specialty refractories. Relationship between physical properties of various refractories. Selection and use of refractories in the materials and metallurgical industry.	**New course adopted as per the guidelines of ECRDC.**

Recommended book(s) for the proposed course
(Author's name, "Title", edition, publisher, publication year).

Text book(s)

1. David W. Richerson, William E. Lee, Modern Ceramic Engineering: Properties, Processing, and Use in Design, 4th edition, CRC Press, 2018.
2. M. Bengisu, *"Engineering Ceramics"*, Springer, 2001.

Reference Book(s)

1. Narottam P. Bansal, Jacques Lamon, Ceramic Matrix Composites, Wiley, 2014.
2. M.N. Rahaman, Ceramic Processing and Sintering, 2nd edition, CRC Press, 2003.

Other Equivalent Courses
(offered in this University)

NED University of Engineering and Technology

COURSE DESIGN FORM

F/QSP 07/05/01

MY-311 Machine Learning in Metallurgical Engineering

EXISTING				APPROVED				✓New Course • Revised Course ✓Compulsory Course • Elective Course Applicable from **Batch 2025**
				MY-311 Machine Learning in Metallurgical Engineering				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th	**0**	**0**	**0**	**Th.**	**2**	**2**	**100**	
Pr.	**0**	**0**	**0**	**Pr.**	**1**	**3**	**50**	REMARKS
				Introduction to Artificial Intelligence: Overview of Artificial Intelligence and its relevance in metallurgy. Introduction to Machine learning (Supervised, Unsupervised, and Reinforcement). Introduction to Deep learning (ANN, and CNN, Introduction to Materials databases (i.e. Pymatgen, RDkit, Matminer). Introduction to Python Libraries (NumPy, Pandas, Matplotlib, Scikit-Learn, Tensorflow). Data Preprocessing and Feature Engineering: Data cleaning, transformation, and normalization techniques, Feature selection and extraction methods for metallurgical data (I.e. Pearson correlation, LASSO, SISSO), Handling missing data and outliers in datasets (i.e. Imputation and its types, , Min-Max, Z-scores), Dimensionality Reduction (PCA, t-SNE) for Visualizing Data. Supervised & Unsupervised Learning Algorithms: Regression Models (Linear Regression, Polynomial Regression, Logistic Regression) for Predictive modeling, Classification Models (Decision Trees, Random Forest, SVM) for Alloy Composition Analysis, Model evaluation measures (RMSE, R^2, Confusion Matrix, Precision, Recall), Clustering Techniques (K-Means, Hierarchical Clustering) for Microstructure Analysis, Anomaly detection methods in metallurgical data analysis, Image Processing for Microstructure Analysis using CNNs. AI Project Work and Applications: Implementation of AI algorithms to solve metallurgical engineering problems (strength prediction, band gap estimation, Materials designing, prediction of structures, etc.). Hands-on project applying machine learning and deep learning techniques to real-world metallurgical datasets (Machine Learning, Computer Vision, Time series)				**New course adapted, as per ECRDC recommendations.**

Recommended book(s) for the proposed course
(Author's name, "Title", edition, publisher, publication year).

Textbook(s)

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 4th Edition, Pearson, 2020.
2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", 1st Ed, MIT Press, 2022.

Reference Book(s)

1. Alex Smola, "Introduction to Machine Learning", Cambridge University Press, 2021. Zhang, "Artificial Intelligence for Materials Science"1st ed, Springer, 2021
2. Robert Johansson, "Numerical Python" 2nd ed, Apress, 2018

Other Equivalent Courses
(offered in this University)

NED University of Engineering and Technology
COURSE DESIGN FORM
MY-415 Design, Selection, and Characterization of Engineering Materials

F/QSP 07/05/01

EXISTING				APPROVED				✓New Course • Revised Course ✓Compulsory Course • Elective Course Applicable from **Batch 2025**
				MY-415 Design, Selection, and Characterization of Engineering Materials				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th.	**0**	**0**	**0**	**Th.**	**3**	**3**	**100**	
Pr.	**0**	**0**	**0**	**Pr.**	**1**	**3**	**50**	REMARKS
				Materials Design: Design philosophy and process, types of design, **design tools, and** materials **data.** Materials designed for specific applications, i.e., Structural, High temperature, corrosion, and wear-resistant applications. Materials Selection: The selection procedure, Selection strategy, **material property/Ashby charts, attribute limits, and material index, selection with multiple constraints and conflicting objectives. Computer-aided selection. Correlation among process, material, structure, and environment/application.** Characterization techniques: Overview of characterization techniques of engineering materials, **Quantitative metallography,** 1-Microscopic Techniques: Configuration/ construction, working principle, image formation, and **results interpretation of;** Optical microscope (OM), Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), and **Scanning Probe Microscopes (SPM).** 2-X-ray Techniques: Production and absorption of X-rays; electrons-matter interactions, **X-ray Diffraction (XRD) and electron Diffraction (ED), Bragg's law, X-ray and electron Diffraction patterns and their Indexing**; 3-Spectroscopic Techniques & Chemical Analysis: Working principle and results interpretation of various Spectroscopic techniques **i.e. Fourier Transform Infrared Spectroscopy(FTIR), spark emission/absorption spectroscopy,** wavelength dispersive spectroscopy (WDS) and energy dispersive (EDS) spectroscopy, and X-ray fluorescence (XRF). 4-Thermal Analysis: Working principle and **results interpretation of various Thermal analytical techniques i.e**., Differential Scanning Calorimetry (DSC), Thermogravimetric Analysis (TGA), and Dilatometry etc.				**The course has been adopted in place of MY-407 with revised content.**

Recommended book(s) for the proposed course
(Author's name, "Title", edition, publisher, publication year).

Textbook(s)

1. M. F. Ashby "Materials Selection in Mechanical Design", 4th ed. Butterworth-Heinemann, 2021
2. E. N. Kaufmann, "Characterization of Materials", 2nd ed. Wiley, 2022

Reference Book(s)

1. M.A Maleque "Materials Selection and Design", 1st d, Springer, 2020 Sharma "Handbook of Materials Characterization" 1st ed, Springer, 2018
2. D. Cebon, "Materials: Engineering, Science, Processing and Design", 4th ed. Butterworth-Heinemann,2018

Other Equivalent Courses
(offered in this University)

F/QSP 07/05/01

NED University of Engineering and Technology
COURSE DESIGN FORM
MY-416 Health, Safety & Environment

EXISTING				APPROVED				✓New Course • Revised Course ✓Compulsory Course • Elective Course Applicable from **Batch 2025**
				MY-416 Health, Safety & Environment				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th.	**0**	**0**	**0**	**Th.**	**1**	**1**	**100**	
Pr.	**0**	**0**	**0**	**Pr.**	**0**	**0**	**0**	REMARKS
				Introduction to HSE in Metallurgical Engineering, Chemical Hazards and Safe Handling, High-Temperature and Mechanical Hazards, Nanomaterials and Particulate Safety, Environmental Impact of Materials Processing, Risk Assessment and Emergency Preparedness, Global HSE Standards and Compliance, Final Assessment & Presentations.				**New Course adapted from ERCDC recommendations.**

Recommended book(s) for the proposed course
(Author's name, "Title", edition, publisher, publication year).

Textbook(s)

1. Jeremy Stranks, *"The A-Z of Health and Safety"*, illustrated edition, Thorogood, 2006.
2. Jeremy Stranks, *"The Manager's Guide to Health and Safety at Work"*, 8th edition, Kogan Page, 2006.

Reference Book(s)

1. Ogletree, Deakins, Nash, Smoak & Stewart, *"Occupational Safety and Health Law Handbook"*, 4th edition, Bernan Press, November 30, 2023.
2. Phil Hughes & Ed Ferrett, *"Introduction to Health and Safety at Work"*, 7th edition, Routledge, 2020.

Other Equivalent Courses
(offered in this University)

F/QSP 07/05/01

NED University of Engineering and Technology

COURSE DESIGN FORM

MY-417 Computational Materials Science

EXISTING				APPROVED				✓New Course • Revised Course ✓Compulsory Course • Elective Course Applicable from **Batch 2025**
				MY-417 Computational Materials Science				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th.	**0**	**0**	**0**	**Th.**	**1**	**1**	**100**	
Pr.	**0**	**0**	**0**	**Pr.**	**2**	**6**	**50**	REMARKS
N/A				Introduction to Computational Materials Science: Basic concepts of atoms and molecules. Types of atomic structures in metals and alloys (crystal lattices). Visualizing atomic structures using simple software (like Jmol or online tools). Overview of computational methods in materials science. Basic linear algebra, numerical methods, and statistical analysis relevant to material simulations. Modeling and Simulation of Materials' Behavior/properties: Molecular dynamics simulations, Density functional theory (DFT), and calculations using Monte Carlo simulations, Finite Element Analysis (FEA). Stress-strain behavior in materials: elasticity, plasticity, and fracture. Computational techniques for studying phase transformations in metallurgical processes, Phase diagram calculations and phase transformation kinetics, Applications of computational methods in predicting phase changes. Hands-on Projects and Case Studies: Simulation projects using software tools e.g., Python/MATLAB, Solidworks/ Materials Studio/ Comsol/ ABAQUS/ANSYS, LAMMPS, Factsage, and others. Case studies on materials design and process optimization through computational methods.				New Course adapted from ERCDC recommendations.

Recommended book(s) for the proposed course
(Author's name, "Title", edition, publisher, publication year).

Textbook(s)

1. J.G. Lee, "Computational Materials Science: An Introduction" , 2nd ed, CRC Press, 2022
2. Richard LeSar, "Introduction to Computational Materials Science: Fundamentals to Applications" , 1st ed, Cambridge University Press, 2021

Reference Book(s)

1. Pereira, "COMSOL Multiphysics 5 - A Brief Introduction to CFD and Electromagnetism" 1st ed, 2020.
2. Hung, "Quantum ESPRESSO Course for Solid-State Physics: A Hands-On Guide", 1st ed, Jenny Stanford, 2022

Other Equivalent Courses
(offered in this University)

NED University of Engineering and Technology

COURSE DESIGN FORM

MY-418 Advanced Materials

F/QSP 07/05/01

EXISTING				APPROVED				• New Course ✓ Revised Course • Compulsory Course ✓ Elective Course Applicable from **Batch 2025**
MY-402 Advanced Materials				**MY-418 Advanced Materials**				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th	**3**	**3**	**100**	**Th**	**2**	**2**	**100**	
Pr.	**0**	**0**	**0**	**Pr**	**0**	**0**	**0**	REMARKS

Introduction:~~Development of new breeds of engineering materials, smart materials and functionally gradient materials, biomaterials. Semiconductors, superconductors, optical and magnetic materials.~~ Magnetics Materials:~~Classification of materials according to magnetic properties. Magnetic fields, flux density and magnetization. Magnetic materials, magnetic measurements. Magnetic properties of materials, hysteresis. Technological application, soft magnetic materials for electromagnets, hard magnetic materials, permanent magnets, magnetic recording technology~~. Biomaterials:Basic chemical and physical properties of biomaterials, including metals, ceramics, and polymers, as they are related to their manipulation by the engineer for incorporation into living systems. Role of microstructure properties in the choice of biomaterials and design of artificial organs, implants, and prostheses.
High Temperature Materials:Overview Elevated-Temperature Characteristics of Materials, Mechanical Properties at Elevated Temperatures, Corrosion at Elevated Temperatures. Processing and Properties of Super alloys. Directionally Solidifies and Single-Crystal Super alloys. ~~Elevated-Temperature Corrosion of Super alloys. Microstructural Instabilities~~. Heat-resistant materials, ~~Titanium Alloys, Refractory Metals and Alloys Structural Intermetallic Ceramics Carbon-Carbon Composites.~~ Materials for Aerospace applications. Materials for nuclear applications. Nanomaterials: Overview of Nanomaterials and their classification. Mechanically alloyed Nanomaterials, ODS alloys, Nanostructured materials, Fuel cell Materials, Materials for Hydrogen Storage, Ceramic and Ceramic matrix composites, Metal Matrix composites. ~~Shape memory alloys~~ Application of Computer in Advanced materials.

Introduction to advanced materials, the structure-property co-relationships of advanced materials, Characterization techniques for nanomaterials (TEM, XRD, etc.), Introduction to magnetic Materials and their Applications, Biomaterials: Basic chemical and physical properties of biomaterials, including metals, ceramics, and polymers. Role of microstructure properties in the choice of biomaterials and design of artificial organs, implants, and prostheses. High-Temperature Materials: Overview, Elevated-Temperature Characteristics of Materials, Mechanical Properties at Elevated Temperatures, Corrosion at Elevated Temperatures. Processing and Properties of Superalloys. Nanomaterials: Overview of Nanomaterials and Their Classification. Mechanically alloyed Nanomaterials, ODS alloys, Fuel cells and Materials, Materials for Hydrogen Storage, Ceramic and Ceramic matrix composites, and Metal-Matrix composites.

Content is reduced Credit hours are modified, i.e., from 3 to 2.

Recommended book(s) for the proposed course

(Author's name, "Title", edition, publisher, publication year).

Textbook(s)

1. Ajit Behra, Advanced Materials, an introduction to Modern Material Science, Springer 2021
2. Armand Soldera, Theodorus van de Ven, Advanced Materials, De Gruyter, 2020

Reference Book(s)

1. The Handbook of Advanced Materials, James K. Wessel, John Wiley & Sons, Inc, ASM International, 2015.
2. James K. Wessel, "Handbook of Advanced Materials: Enabling New Designs", Wiley, 2024

Other Equivalent Courses

(offered in this University)

1. Course Title (Course Code)
2. Course Title (Course Code)
3. Course Title (Course Code)
4. Course Title (Course Code)

Course Title (Course Code)

NED University of Engineering and Technology
COURSE DESIGN FORM
MY-419 High-Temperature Metals and Alloys

F/QSP 07/05/01

EXISTING				APPROVED				✓New Course • Revised Course • Compulsory Course ✓Elective Course Applicable from **Batch 2025**
				MY-419 High-Temperature Metals and Alloys				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th.	**0**	**0**	**0**	**Th.**	**2**	**2**	**100**	
Pr	**0**	**0**	**0**	**Pr.**	**0**	**0**	**0**	REMARKS
				Overview of Elevated-Temperature Characteristics of Engineering Materials, Mechanical Properties, and Corrosion. Industrial Applications of Heat-Resistant Materials. Properties of Superalloys, Metallurgy, Processing and Properties of Superalloys. Elevated-Temperature Corrosion of Materials. Microstructural Instabilities. Protective Coatings Properties of Nonferrous Heat-Resistant Materials. Refractory Metals and Alloys. Structural Intermetallic Ceramics Carbon-Carbon Composites. Analysis and Design Assessment of Creep-Rupture Data. Thermomechanical Fatigue of Structural Materials. Elevated-Temperature Crack Growth. Creep-Fatigue Interaction. Materials design for Elevated Temperature Applications. Design for Oxidation Resistance, Creep, thermal fatigue, oxidation, high temperature corrosion, erosion. Ageing, structural changes, material damage, Crack propagation, damage mechanics, life time analysis, Creep resistant steels, superalloys, ceramics, and polymers for high temperature applications, intermetallic, Usage of high strength steels. Spring materials. Fatigue, Evaluation of property data, and extrapolation. Plastics and composite materials for high temperature applications.				**New course adopted as per the guidelines of ECRDC/PEC.**

Recommended book(s) for the proposed course

(Author's name, "Title", edition, publisher, publication year).

Textbook(s)

1. Birks, N., H. Meier, F.S. Pettit,"Introduction to the High Temperature Oxidation of Metals", 2nd edition, Cambridge University Press, 2006.
2. Reed, R.C.,"The Superalloys: Fundamentals and Applications", 1st edition, Cambridge University Press, 2006.

Reference Book(s)

1. Roger C. Reed, T. C. Lindley, "Superalloys: Applications, Metallurgy, and Performance", 1st edition, Elsevier, 2023.
2. Josef R. Oppenheimer, "High-Temperature Materials and Mechanisms", 1st Edition, CRC press 2011

Other Equivalent Courses

(offered in this University)

NED University of Engineering and Technology
COURSE DESIGN FORM
MY- 420 Nanotechnology

F/QSP 07/05/01

EXISTING				APPROVED				✓New Course • Revised Course • Compulsory Course ✓Elective Course Applicable from **Batch 2025**
				MY-420 Nanotechnology				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th.	**0**	**0**	**0**	**Th.**	**2**	**2**	**100**	
Pr.	**0**	**0**	**0**	**Pr.**	**0**	**0**	**0**	REMARKS
N/A				Fundamentals and evolution of nanomaterials and Nanotechnology, Scope of Nanotechnology, importance of nanotechnology in materials science and engineering, classification of nanomaterials; OD, 1D, 2D, 3D nanomaterials. Applications of nanotechnology & nanomaterials in Metallurgical Engineering (corrosion resistance, alloy and composites, thin film coatings). Properties of nanomaterials: Mechanical, electrical, optical, and magnetic properties, Size-dependent properties and quantum effects, Surface energy and reactivity of nanomaterials. Synthesis of nanomaterials; Top-down and bottom-up techniques, chemical synthesis (CVD, hydrothermal, sol-gel), physical synthesis (PVD, ball milling). Carbon, metal, ceramics, composite, and polymer-based nanomaterials. Environmental HSE aspects of nanotechnology.				**New course adopted as per the guidelines of ECRDC/PEC.**

Recommended book(s) for the proposed course
(Author's name, "Title", edition, publisher, publication year).

Textbook(s)

1. Amretashis Sengupta, Chandan Kumar Sarkar, *"Introduction to Nano: Basics to Nanoscience and Nanotechnology"*, 1st Edition, Springer, 2015.

2. " Dieter Vollath, *"Nanomaterials: An Introduction to Synthesis, Properties, and Applications"*, 2nd Edition, Wiley-VCH, 2013.

Reference Book(s)

1. "Nanostructures & Nanomaterials: Synthesis, Properties & Applications" by Guozhong Cao
2. Nanotechnology: Principles and Practices. Kulkarni, Sulabha K., 2014 (latest edition

Other Equivalent Courses
(offered in this University)

NED University of Engineering and Technology

COURSE DESIGN FORM

F/QSP 07/05/01

MY-421 Fundamentals of Biomaterials

EXISTING				APPROVED				✓New Course • Revised Course • Compulsory Course ✓Elective Course Applicable from **Batch 2025**
				MY-421 Fundamentals of Biomaterials				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th.	**0**	**0**	**0**	**Th.**	**2**	**2**	**100**	
Pr	**0**	**0**	**0**	**Pr.**	**0**	**0**	**0**	REMARKS
N/A				Introduction to biomaterials and biochemistry; biocompatibility and bioactivity, bioreabsorbable & bioerodible materials. Processing and applications of biomaterials. Hydrogels & smart polymers. Cell biology, surface properties of materials, and intermolecular forces in biology. Response of materials in a human body; effect of mechanical forces on cells & tissues; biomimetic materials; Importance of water in biomaterials. In-vivo and In-vitro testing. Biocompatible metals: Ti-based, Stainless Steels, Co-Cr-Mo alloys, nitinol; biomaterials surface & protein; textured & porous materials; Bioactive glasses; Bioresorable ceramics; adhesives & sealants. Applications (Orthopedic, Dental, cardiovascular, soft tissue replacement, hard tissue replacement); Drug delivery system (nano-carriers, polymer-drug conjugates, nucleic acids, etc.), Biomaterial corrosion; blood & Materials interaction; tumors associated with biomaterials.				**New course adopted as per the guidelines of ECRDC/PEC.**

Recommended book(s) for the proposed course

(Author's name, "Title", edition, publisher, publication year).

Textbook(s)

1. **Firat D. Tuncel,** "Biomaterials: Principles and Practices", **1st Edition**, **Elsevier**, **2017**.
2. **Buddy D. Ratner,** "Biomaterials Science: An Introduction to Materials in Medicine", **3rd Edition**, **Academic Press**, **2013**.

Reference Book(s)

1. Frederick H. Silver, David L. Christiansen, "Biomaterials Science and Biocompatibility", 1st Edition, Springer, 1999.
2. C. Mauli Agrawal, Jack McAninly, Mark Appleford, Gopal P. Rao, "Introduction to Biomaterials: Basic Theory with Engineering Applications", 1st Edition, Cambridge University Press, 2013.

Other Equivalent Courses

(offered in this University)

NED University of Engineering and Technology

COURSE DESIGN FORM

MY- 422 Electronic, Magnetic, and Optical Materials

F/QSP 07/05/01

EXISTING				APPROVED				✓New Course • Revised Course • Compulsory Course ✓Elective Course Applicable from **Batch 2025**
				MY- 422 Electronic, Magnetic, and Optical Materials				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th.	**0**	**0**	**0**	**Th.**	**2**	**2**	**100**	
Pr.	**0**	**0**	**0**	**Pr.**	**0**	**0**	**0**	REMARKS
				Classification and concept of Electrical and Electronic Materials. Metallic materials and their electrical properties. Semiconductor materials and their electrical properties. Semiconductor devices. Ceramic materials used in electronic applications. Magnetic materials. Classification of materials according to magnetic properties and applications. Paramagnetic, diamagnetic, ferromagnetic, antiferromagnetic, and ferrimagnetic materials. Soft and Hard magnetic materials, magnetic recording technology. Atomic and domain theory of magnetism. Basic terms: magnetic fields, flux density and magnetization, permeability, susceptibility, retentivity. Hysteresis loop. Types of magnetic behavior. Magnetic measurement techniques. Optical materials. Characteristics and types of optical materials. Applications of Optical materials.				**New course adopted as per the guidelines of ECRDC/PEC.**

Recommended book(s) for the proposed course
(Author's name, "Title", edition, publisher, publication year).

Textbook(s)

1. W. F. Smith and Javad Hashemi, "Foundations of Materials Science and Engineering", 7th edition, McGraw Hill, 2022.
2. K. S. Potter and J. H. Simmons, "Optical Materials", 2nd edition, Elsevier, 2021.

Reference Book(s)

1. W. D. Callister and D. G. Rethwisch, "Fundamentals of Materials Science and Engineering: An Integrated Approach", 5th edition, Wiley, 2018.
2. Pradeep Fulay and Jung-Kun Lee, "Electronic, Magnetic, and Optical Materials", 2nd edition, CRC Press, 2017

Other Equivalent Courses
(offered in this University)

NED University of Engineering and Technology
COURSE DESIGN FORM
MY-423 Thin Films and Coating Techniques

F/QSP 07/05/01

EXISTING				APPROVED				✓New Course • Revised Course • Compulsory Course ✓Elective Course Applicable from **Batch 2025**
				MY-423 Thin Films and Coating Techniques				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th.	**0**	**0**	**0**	**Th.**	**2**	**2**	**100**	
Pr.	**0**	**0**	**0**	**Pr.**	**0**	**0**	**0**	REMARKS
N/A				Introduction to thin film technology. Thin film deposition and growth mechanism by Physical vapor deposition (PVD) techniques like evaporation, sputtering, ion-plating, etc. Chemical coating methods such as chemical vapor deposition (CVD) and atomic layer deposition (ALD). Plasma-based methods for thin film deposition. Molecular Beam Epitaxial (MBE) growth. Different physical and chemical processes. Solution processing methods for coatings and thin film deposition, Substrate effects of coating deposition. Tribological and hard thin coatings. Functional coatings for devices. Models for nucleation and film growth. Morphology and texture. Applications of thin film materials and deposition technologies.				**New course adopted as per the guidelines of ECRDC/PEC.**

Recommended book(s) for the proposed course
(Author's name, "Title", edition, publisher, publication year).

Textbook(s)

1. F. M. Mwema, T.-C. Jen, L. Zhu. "Thin Film Coatings: Properties, Deposition, and Applications"1st ed. CRC Press (2022)
2. H. Frey, H. R. Khan. "Handbook of Thin Film Technology"1st ed. Springer (2015)

Reference Book(s)

1. Chandio and Channa,"Thin Films and Coatings: Engineering Applications" 1st Edition, Springer Nature, 2025.
2. S. Kumar, D. K. Aswa. "Recent Advances in Thin Films"1st ed. Springer (2020)

Other Equivalent Courses
(offered in this University)

NED University of Engineering and Technology
COURSE DESIGN FORM
MY- 424 Surface Engineering

F/QSP 07/05/01

EXISTING				APPROVED				✓New Course • Revised Course • Compulsory Course ✓Elective Course Applicable from **Batch 2025**
				MY-424 Surface Engineering				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th.	**0**	**0**	**0**	**Th.**	**2**	**2**	**100**	
Pr.	**0**	**0**	**0**	**Pr.**	**0**	**0**	**0**	REMARKS
N/A				Tribology of surfaces: surface integrity; surface roughness and waviness; measurement of surface roughness and texture; types of wear and their mechanisms; applications of lubrication in wear. Mechanical surface treatment: Propelling abrasive media; blasting techniques; selection of abrasive media; different peening techniques. Surface finishing methods: tumbling, vibratory finishing, belt Sanding, wire brushing, buffing, and electro-polishing. Chemical cleaning of surfaces: selection and applications; alkaline cleaning; solvent cleaning and vapor degreasing; molten salt bath cleaning; ultrasonic cleaning; acid cleaning; pickling and descaling. Coatings: Paints and organic coatings; powder coating; hot-dip coating; chemical conversion coatings; blackening; coloring of metals; electroplating, electrophoretic deposition; anodizing; electroless plating; mechanical plating. Coating techniques: PVD, CVD, Sputtering, Thermal, and cold spraying methods; Sputtering; sol-gel method. A brief overview of surface hardening methods. Cladding techniques: roll bonding; explosive welding; applications of cladding in nuclear, marine, and other technological fields.				**New course adopted as per the guidelines of ECRDC/PEC.**

Recommended book(s) for the proposed course
(Author's name, "Title", edition, publisher, publication year)

Textbook(s)

1. D. K. Dwivedi. "Surface Engineering: Enhancing Life of Tribological Components"1st ed. Springer (2018)
2. C. I. Pruncu, A. Aherwar, S. Gorb, "Manufacturing Processes for Engineering Materials" 1st ed. CRC Press (2021).

Reference Book(s)

1. Chandio and Channa," Thin Films and Coatings: Engineering Applications" 1st Edition, Springer Nature, 2025.
2. S. Kalpakjian, S. R.Schmid. "Manufacturing Processes for Engineering Materials"6th ed. Pearson (2021)

Other Equivalent Courses
(offered in this University)

NED University of Engineering and Technology

COURSE DESIGN FORM

MY-425 Additive Manufacturing

F/QSP 07/05/01

EXISTING				APPROVED				✓New Course • Revised Course • Compulsory Course ✓Elective Course Applicable from **Batch 2025**
				MY- 425 Additive Manufacturing				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th.	**0**	**0**	**0**	**Th.**	**2**	**0**	**100**	
Pr.	**0**	**0**	**0**	**Pr.**	**0**	**0**	**0**	REMARKS
N/A				An overview of additive manufacturing: how it is different from conventional manufacturing processes, and its history. Process fundamentals, structure shaping, and creation; applications of additive manufacturing. Role of CAD and laser scanning. Final component geometry. Different techniques used for 3D printing of metallic (SLM, EBM, LMD, powder DED, wire DED, binder jetting, BPE, etc.), polymeric (FDM, SLS, stereolithography, etc.), and other materials. Design implications: surface finish; microstructures, mechanical and other properties; residual stresses and effects on fatigue life.				**New course adopted as per the guidelines of ECRDC/PEC.**

Recommended book(s) for the proposed course

(Author's name, "Title", edition, publisher, publication year).

Text book(s)

1. N. Accialini ; Introduction to Additive Manufacturing: technologies, materials, benefits, challenges and applications. (2022)

Reference books

1. Ian Gibson, David W. Rosen, Brent Stucker, *"Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing"*, 3rd Edition, Springer, 2021.
2. I. Gibson, D. Rosen, B. Stucker by Additive Manufacturing Technologies

Other Equivalent Courses

(offered in this University)

F/QSP 07/05/01

NED University of Engineering and Technology
COURSE DESIGN FORM
MY-426 Phase Transformations in Metals and Alloys

<table>
<tr><td colspan="5">EXISTING</td><td colspan="4">APPROVED</td><td rowspan="3">✓New Course
• Revised Course
• Compulsory Course
✓Elective Course
Applicable from Batch 2025</td></tr>
<tr><td colspan="5"></td><td colspan="4">MY- 426 Phase Transformations in Metals and Alloys</td></tr>
<tr><td></td><td>Cr. Hrs.</td><td>Contact Hrs.</td><td>Exam Marks</td><td></td><td></td><td>Cr. Hrs.</td><td>Contact Hrs.</td><td>Exam Marks</td></tr>
<tr><td>Th.</td><td>0</td><td>0</td><td>0</td><td>Th.</td><td></td><td>2</td><td>2</td><td>100</td><td></td></tr>
<tr><td>Pr.</td><td>0</td><td>0</td><td>0</td><td>Pr.</td><td></td><td>0</td><td>0</td><td>0</td><td>REMARKS</td></tr>
<tr><td colspan="5">N.A</td><td colspan="4">Introduction to Phase Transformations: Definition and classification of phase transformations, Thermodynamic aspects: phase stability, and driving force. Nucleation and Growth Mechanisms: Homogeneous vs. heterogeneous nucleation, Growth kinetics, and interface movement. Diffusion in Solids: Atomic mechanisms of diffusion (vacancy, interstitial, dislocation), Fick's laws and diffusion kinetics, Role of diffusion in phase transformations, Diffusional Transformations: Fundamentals of diffusional transformations, characteristics, Eutectic and eutectoid reactions, Spinodal decomposition and precipitation processes. Displacive Transformations: Characteristics of displacive transformation products, Crystallographic features of martensite and bainite, Strain energy, and interface motion. Bainitic Transformation and Mechanisms. Thermodynamic and kinetic factors controlling bainitic transformation, upper and lower bainite formation mechanisms. Design of Bainitic Alloys: Role of phase transformation in Bainitic steel design, Industrial applications of Bainitic steels. Order-Disorder Transformations in Alloys: Atomic ordering in solid solutions, Examples: CuAu and Fe3Al systems: Advanced Topics and Case Studies: Phase transformations in high-entropy alloys (HEAs), Case studies on bainitic and martensitic steel development, Discussion on research trends in phase transformation engineering.</td><td>New course adopted as per the guidelines of ECRDC/PEC.</td></tr>
<tr><td colspan="9">Recommended book(s) for the proposed course
(Author's name, "Title", edition, publisher, publication year).
Textbook(s)
1. D. A. Porter, K. E. Easterling, M. Y. Sherif, Phase Transformation in Metals and Alloys, 4th Edition,. CRC Press, 2021.
2. Harshad K. D. H. Bhadeshia Haixue Yan, Phase Transitions An introduction with worked examples, Independently published, 2023.
3.
Reference Book(s)
1. H.K.D.H. Bhadeshia , R.W.K. Honeycombe Steels: Microstructure and Properties 3rd Edition, 2017
2. H.K.D.H. Bhadeshia, Bainite in Steels: Theory and Practice, 3rd Edition, CRC Press, 2015</td><td>Other Equivalent Courses
(offered in this University)</td></tr>
</table>

NED University of Engineering and Technology

COURSE DESIGN FORM

MY- 427 Metallurgical Plants and Quality Control

EXISTING				APPROVED				• New Course F/QSP 07/05/01 ✓Revised Course • Compulsory Course ✓Elective Course Applicable from **Batch 2025**
MY- 409: Metallurgical Plants and Quality Control				**MY- 427 Metallurgical Plants and Quality Control**				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th.	**3**	**3**	**100**	**Th.**	**2**	**2**	**100**	
Pr.	**0**	**0**	**0**	**Pr.**	**0**	**0**	**0**	REMARKS
Metallurgical plant location, Factors affecting location; Multi-plant location; Plant layout; product and process layout analysis; Layout comparison. ~~Type of Pollutants and their treatment, Overview of environmental impacts of Iron and Steel making, Hot rolling, Forging, Cold rolling, Annealing and Tempering, Coating and Plating plants. Environmentally friendly metallurgical plants~~. Occupational Health and Safety Impacts of Metallurgical plants. Basic procedures and remedies. ~~Applications of computers for environmental and Pollution Control and Waste management in metallurgical plants~~. ~~Fundamentals of statistics and analysis techniques~~. Probability distributions. AQL, ~~AOQL,~~ LTPD, attributes sampling, variable sampling, selection of proper sampling plan. ~~Reliability and maintainability, inspection of different types of materials and products for evaluation of quality reliability of flaw detection by non-destructive inspection, quality control applications of non-destructive inspection. Introduction to standards~~. Familiarization of standards for testing of materials, ~~ASTM, BS, JIS GOST and ISO. Pakistan Standards, Quality assurance for final products, Measures for quality control.~~				Metallurgical Plant Location: Factors affecting location; Multi-plant location; Location analysis; Plant layout; **Types of layout; Material handling consideration in layout; Internal and External balancing;** product and process layout analysis; Layout comparison. Health and Safety: Occupational Health and Safety Impacts of Metallurgical Plants. Basic procedures and remedies. **Quality control Introduction, Defining Quality & its Philosophies, defining SPC/SQC and its Tools/Techniques. Quality Control Tools: Flow Chart, Check Sheet, Histogram, Pareto Chart, box plot, Scatter Diagram, Cause and Effect Diagram, Variable & Attribute Control Charts. Acceptance Sampling: OC Curve, Consumer & Producer Risks, AQL & LTPD, Sampling Errors, Acceptance Sampling for Continuous Production, Acceptance by Variables, Single, Double, & Sequential Sampling. Process Capability: Cp/Cpk, Reliability: Introduction, Life History Curve, Taguchi Loss Function, Probability distribution, Total Quality** Management. Familiarization with standards for testing of materials.				**Credit hours have been changed from 3 to 2.**

Recommended book(s) for the proposed course
(Author's name, "Title", edition, publisher, publication year).

Textbook(s)

1. Deepak Malhotra, " Tools for Plant Auditing : A Powerful Tool for Improving Metallurgical Plant Performance", CIM, 2015
2. Amitava Mitra, " Fundamentals of Quality Control and Improvement", 4th edition 2019.

Reference Book(s)

1. Rob Boom, Chris Twigge-Molecey, Frank Wheeler, "Metallurgical Plant Design", 1st Edition, Canadian Institute of Mining, Metallurgy and Petroleum (CIM), 2015.
2. Douglas C. Montgomery, "Introduction to Statistical Quality Control", 8th Edition, Wiley, 2020.

Other Equivalent Courses
(offered in this University)

F/QSP 07/05/01

NED University of Engineering and Technology

COURSE DESIGN FORM

MY-428 Nuclear Metallurgy

EXISTING				APPROVED				✓New Course • Revised Course • Compulsory Course ✓Elective Course Applicable from **Batch 2025**
				MY- 428 Nuclear Metallurgy				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th.	**0**	**0**	**0**	**Th.**	**2**	**2**	**100**	
Pr.	**0**	**0**	**0**	**Pr.**	**0**	**0**	**0**	REMARKS
N.A				Overview of Nuclear Systems, Nuclear energy, nuclear reactors. Introduction to nuclear power plant operation, nuclear fission and fusion reactions, neutron absorption cross section. Nuclear fuels: uranium, thorium, plutonium; Fuel cladding materials: Aluminum alloys, stainless steels, zirconium alloys; Reflecting materials: graphite, beryllium, moderators, light water, heavy water, graphite; Control rod materials: cadmium, boron. Overview of UO2, Irradiation hardening, and embrittlement. Structural materials in nuclear power plants: An overview of Materials used in nuclear power plants. Effect of radiation on the properties of materials. Radiation hazards and their safety, Radiation Damage, health physics. Disposal of radioactive waste.				**New course adopted as per the guidelines of ECRDC/PEC.**

Recommended book(s) for the proposed course
(Author's name, "Title", edition, publisher, publication year).

Textbook(s)

1.K.L. Murty, Indrajit Charit, "Introduction to Nuclear Materials", 1st edition, Wiley, 2012
2.Karl Whittle, "Nuclear Materials Science", 1st edition, CRC Press, 2017

Reference Book(s)

1. Gary S. Was, "Fundamentals of Radiation Materials Science: Metals and Alloys", 2nd edition, Springer, 2012
2. Author: A. K. Mohanty, "Introduction to Nuclear Materials: Fundamentals and Applications", 1st Edition, CRC Press, 2021.

Other Equivalent Courses
(offered in this University)

F/QSP 07/05/01

NED University of Engineering and Technology
COURSE DESIGN FORM
MY-429 Oilfield Metallurgy

EXISTING				APPROVED				✓New Course • Revised Course • Compulsory Course ✓Elective Course Applicable from **Batch 2025**
				MY- 429 Oilfield Metallurgy				
	Cr. Hrs.	**Contact Hrs.**	**Exam Marks**		**Cr. Hrs.**	**Contact Hrs.**	**Exam Marks**	
Th.	**0**	**0**	**0**	**Th.**	**2**	**2**	**100**	
Pr.	**0**	**0**	**0**	**Pr.**	**0**	**0**	**0**	REMARKS
N.A				Introduction to the oilfield environment: fundamentals of oil and gas and their effect on materials. Special features of oilfield metallurgy. API Material classes. NACE MR0175/ ISO 15156. Basics of Metallurgy and Materials Science: Metallurgy and properties of low alloy steels, Hardenability of oil tool materials, Effect of alloying elements, Heat treatment, Weldability of oil tool materials, Factors affecting material selection. Corrosion-resistant alloys (CRA): Stainless steels, Nickel alloys, Material selection of CRA. API 6A CRA. Specifications: API 6A, API 17D, NACE standards, etc., applications, and key features of these alloys. Corrosion and Material Properties: Why is oil/gas corrosive? Sweet and Sour Environments. Typical corrosion problems, Stress corrosion cracking, etc. Sour Service: NACE MR0175. ISO 15156, Material selection and sour service. Effect on welding.				**New course adopted as per the guidelines of ECRDC/PEC.**

Recommended book(s) for the proposed course
(Author's name, "Title", edition, publisher, publication year).

Textbook(s)

1. Robert Heidersbach, Metallurgy and Corrosion Control in Oil and Gas Production, John Wiley & Sons, Inc., 2018.

Reference Book(s)

1. Singh, R. "Applied Metallurgy and Corrosion Control: A Handbook for the Oil and Gas Industry" (1st ed.). Gulf Professional Publishing (2015).

Other Equivalent Courses
(offered in this University)

Department of Metallurgical Engineering
Course Dependency Chart