VIVEKANAND COLLEGE, KOLHAPUR
(AUTONOMOUS COLLEGE)

Board of Studies in Foundry Technology

Choice Based Credit System Pattern

Syllabus

For

B. Voc. Part-III

B. Voc in Foundry Technology

(To be implemented from Academic Year 2020-2021 onwards)

STRUCTURE OF SYLLABUS:

To be implemented from the academic year 2020-2021

1. Title of the course: B.VOC IN FOUNDRY TECHNOLOGY

2. Preamble of the syllabus:

The proposed curriculum is with the view to make it more contextual, industry affable and suitable to cater the needs of society and nation in present day context. The committee examined the nature of the existing syllabus of various courses in foundry technology and after analysing other curricula of existing universities in respective subjects in terms of content, relevance, quality and pattern of teaching and examination, has synthesized the present proposal. After guidance from industry professionals, consultants and senior faculty, feedbacks from the core faculty and intensive discussions the syllabus is suitably finalized.

The syllabus needs revision in terms of preparing the student for the professional scenario with relevance to practical needs and requirements. A holistic approach includes providing industry training via on job training/internships, handling live projects, visits to foundry units. Regular expert's interaction will help to build a bridge between students and industry.

Technical advancement is the key to a substantial teaching system in today's world and thus a great responsibility lies on the curriculum to prepare students to rise to meet global standards and align seamlessly to changing trends.

3. Objectives:

To enable the students-

- To promote understanding of basic facts and concepts in foundry process while retaining
- the excitement of foundry industry.
- To make students capable of studying foundry technology in academic and Industrial courses.
- To expose the students to various emerging new areas of foundry technology and apprise them with their prevalent in their future studies and their applications in various spheres of manufacturing technology.
- To develop problem solving skills in students.
- To expose the students to different processes used in Foundry Industries and their applications.
- To develop ability and to acquire the skill and knowledge of terms, facts, concepts, processes, techniques and principles of foundry industries.
- To develop ability to apply the skill and knowledge of contents of principles of foundry technology.
- To inquire of new skill and knowledge of foundry technology and developments therein.
- To expose and to develop interest in the fields of foundry technology.

4. Duration:

The duration of the B.Voc. Course will be of **three years.**

•B.Voc. Part I - Diploma in Foundry Technology

•B.Voc. Part II - Advance Diploma in Foundry Technology

•B.Voc. Part III - B. Voc in Foundry Technology

The final B.Voc degree will be awarded only after completion of three years course. The suggested credits for each of the years are as follows:

Awards		**Normal calendar Duration**	**Skill Component Credits**	**General Education Credits**
Year 1	Diploma in Foundry Technology	Two Semesters	36	24
Year 2	Advanced Diploma in Foundry Technology	Four Semesters	36	24
Year 3	**B.Voc in Foundry Technology**	**Six Semesters**	**36**	**24**
		TOTAL	108	72

General Education Component (i.e. the work in classroom) should not exceed 40% of the total curriculum.

Credits can be defined as the workload of a student in
1. Lectures
2. Practicals
3. Seminars
4. Private work in the Library/home
5. Examination
6. Other assessment activities.

The following formula should be used for conversion of time into credit hours.

a) One Credit would mean equivalent of 15 periods of 60 minutes each, for theory, workshops /labs and tutorials;

b) For internship/field work, the credit weightage for equivalent hours shall be 50% of that for lectures/workshops;

c) For self-learning, based on e-content or otherwise, the credit weightage for equivalent hours of study should be 50% or less of that for lectures/workshops.

5. Medium of Instruction:

The medium of instruction of the course will be **Marathi/English.**

6. Pattern: Credit based Semester Pattern with course outcome.

7. Eligibility:

1. Candidate should be passed Advanced Diploma in 'Foundry Technology"
2. Candidates having Advanced Diploma in „Cast Iron Foundry Technology" are also eligible for the B.Voc degree course.
3. Candidates with Advanced Diploma in „Casting Development and Quality Assurance" are also eligible for the B.Voc degree course.

8. Examination:

A. Scheme of examination:

• The semester examination will be conducted at the end of each term (both theory and practical examination)

• Theory paper will be of 50 marks each. The practical examination will be of 150 marks and industrial practical training/project work of 50 marks in the practical.

• Question papers will be set in the view of the entire syllabus and preferably covering each unit of the syllabus.

For each semester there will be three theory papers. **Practical Examination will be conducted at the end of every semester.**

Paper Number	Title of Paper (For Semester V)	Internal Marks	Theory Exam Marks	Total Marks
I	Secondary Steel Making	10	40	50
II	Quality Control	10	40	50
III	Industrial Management for Foundry	10	40	50
TOTAL		**30**	**120**	**150**

Paper Number	Title of Paper (For Semester VI)	Internal Marks	Theory Exam Marks	Total Marks
IV	Welding and Salvaging Processes	10	40	50
V	Energy Conservation and Pollution Control	10	40	50
VI	Fracture Mechanics and analysis of Failure	10	40	50
TOTAL		**30**	**120**	**150**

The practical examination will be of 200 marks for **each semester**.

Sr. No.	Practical examination	Marks	Internal Assessment	Marks
1	Practical	120	Projects/ Industry Training.	50

2	Journal	15		
3	Oral	15		
Total		150		50

The total weightage of each semester is of 450 marks, the details of which are-

Sr. No.	Title	Marks
1	Theory Examination 50 X 3	150
2	Practical Examination.	200
3	Project Work	50
4	Internship	50
	TOTAL	**450**

B. Nature of question paper:

For each paper there will be **THREE** compulsory questions.

General nature of the question paper will be:

Question Number	**Type**		**Marks**
Q.1	Multiple choice question	No internal options.	8
Q.2	Short answer	Any four out of six	16
Q.3	Long answer	Any two out of three	16

C. Standard of Passing:
To pass the examination a candidate must obtain at least 35% (i.e 14 marks out of 40) in individual subjects, in internal assessment and University examination each in all theory and practical subjects.

D. External Students: Not applicable as this is a practical oriented course**.**

9. University Term: As per academic calendar of the university

For the third year i.e. B. Voc in Foundry Technology practical examination and theory paper assessment will be done at university level.

10. List of equipment and instruments:

1. Universal sand testing machine
2. Sieve analyser.
3. Mold hardness teller.
4. Molding meter.
5. Demonstrative Cupola
6. Rapid moisture teller.
7. Electric Muffle (1000^{oc}**)**
8. Muller (Sand mixing)
9. Metallurgical Microscope = 5/6
10. Metallurgical Microscope with image analysis software = 1

11. Belt abrasive grinder.
12. Bend saw.
12. Cut- off wheel.
13. Lapping wheel for metallography.
14. Coal fired /Gas fired Furnace.
15. Micro Vickers Hardness Tester.
16. Impact testing Machine (with ASTM specimens – set of low & high energies)
17. Manual Broaching Machine.
18. Sub Zero Treatment bath with Digital calibrated temperature indicator.
19. Optical Brinell Hardness Testing Machine.
20. Dynamic Hardness Tester.
21. Digital Hardness Testing Machine.
22. Double Disc Polisher.
23. Medium Abrasive Cutting machine.
24. Hyd. Spec. Mounting Press -Water cooled

11. Workload:

Each skill based paper will have **three theory** periods per week. There are **four practical** per week. Each practical will be based on skill based papers i.e. paper no. I, II, IV, V and VI. The practical batch will have 20 students.

The total workload for one batch will be:

1. **Three Papers** on skill based Education: 3 X 3	=	**09** Theory Periods.
2. **Four Practical** work per week: 4 X 4	=	**16** Practical periods.
3. **Project Work** per batch per week:	=	**05** Periods.

	TOTAL	**30 Periods.**

Working hours will be 5 hours (300 minutes) per day i.e. six periods each of 50 minutes.

12. Laboratory Safety Equipments:

Part I: Personal Precautions:

1. All persons must wear safety Goggles at the time of Practical/Training times.
2. Must wear **Lab Aprons / Lab Jacket** and proper shoes.
3. Except in emergency, over – hurried activities are forbidden.
4. Fume cupboard must be used whenever necessary.
5. Eating, Drinking and Smoking in the laboratories is strictly forbidden.

Part II: Use of Safety and Emergency Equipments:

1. First aid Kits

2. Sand bucket
3. Fire extinguishers (dry chemical and carbon dioxide extinguishers)
4. Material Storage cabinet with proper ventilation
5. Material Safety data sheets.
6. Management of Local exhaust systems and fume hoods.
7. Sign in register if using instruments.

13.MEMORANDUM OF UNDERSTANDING (MOU):

The purpose of this MOU is to clearly identify the roles and responsibilities of each party (i.e. college and industry partner) as they relate to the implementation of the **B.Voc. Programme in Foundry Technology** at the college.

It is suggested to sign at least **TWO MOU** with the industry partners in the related field.

14. PROGRAM OUTCOMES (PO's)

1. B. Voc. Graduates in Foundry Technology will demonstrate knowledge of Machine Drawing, Material Science, Gating System Design & Metallurgy to solve actual casting products/processes related problems in Foundries.
2. Graduates will become Innovators & Entrepreneurs to address social, technical and business challenges.
3. B. Voc. Graduates in Foundry Technology will select and apply relevant modern technique and IT Tools to solve complex problems in design and manufacturing of casting components.
4. B. Voc. Graduates in Foundry Technology will able to understand and solve social, health, legal issues related to foundry.
5. B. Voc. Graduates in Foundry Technology will able to use appropriate environmental friendly processes for foundry to achieve sustainable growth.
6. B. Voc. Graduates in Foundry Technology will be able apply ethical business practices in Industry.
7. B. Voc. Graduates in Foundry Technology will able to work in Industry/Foundry as a team player as well as a team leader.
8. B. Voc. Graduates in Foundry Technology will be able to communicate effectively and professionally at Local to Global level.
9. B. Voc. Graduates in Foundry Technology will be able to apply Project Management Techniques and Financial Management Techniques in foundry.

Program Educational Outcomes:

1. The graduates will apply knowledge gained in course to improve lives and livelihoods through a successful career in Foundry based Companies.
2. The Graduates will engage in lifelong learning such as higher studies & association with professional bodies.

Program Specific Outcomes:

1. B. Voc. Graduates in Foundry Technology will collect and analyze data for solving the problems related with casting by using modeling, analysis & design tools.
2. Make Use of Material Testing Techniques, Sand Testing Techniques & Appropriate Gating Design Techniques for improving quality of product.

B.Voc. Part-III (B.Voc in Foundry Technology)

Course structure

General Structure:

The Degree course has two semesters; each one is of 450 marks. There will be three theory papers for each semester having 50 marks each.

SEMESTER – V

1) Paper-I:Secondary Steel Making - 50 Marks.
2) Paper-II: Quality Control and Reliability - 50 Marks.
3) Paper-III: Industrial Management - 50 Marks.
4) Paper-IV: Project Work-I (Internal Assessment) - 100 Marks.

SEMESTER – VI

1) Paper-V:Welding and Salvaging Processes - 50 Marks.
2) Paper-VI: Energy Conservation and Pollution Control - 50 Marks.
3) Paper-VII: Fracture Mechanics and analysis of Failure - 50 Marks.
4) Paper-VII: Project Work-II (Internal Assessment) - 100 Marks.

There will be practical examination for each semester. The practical examination will be conducted in **two days** each of six hours. It will be of 150 marks of which 30 marks are reserved for oral and journal. The internal assessment of 50 marks includes industry training via internships, handling live projects, visits to foundry units etc.

SYLLABUS

N. B.

(i) Figures shown in bracket indicate the total lectures required for the respective units.

(ii) The question paper should cover the entire syllabus. Marks allotted to questions should be in proportion to the lectures allotted to respective to units.

(iii) All units should be dealt with S.I. units.

(iv) **Industrial training / tour/visit per semester is compulsory.**

(v) Use of recent editions of reference books is essential.

(vi) Use of Scientific calculator is allowed.

B. VOC IN FOUNDRY TECHNOLOGY

SEMESTER V

SKILLED BASED PAPERS:

PAPER XXI: SECONDARY STEEL MAKING

Course Type: Theory / Practical	Theory
Required/Elective	Required
Prerequisite	Information about Steel manufacturing
Teaching Scheme (Lecture/Practical/Tutorial/Drawing)	03/00/00/00 Hours
Total contact Hours (Lecture/Practical/Tutorial/Drawing)	50/00/00/00 Hours
EvaluationScheme: Theory Theory Paper /Term Work/Oral/Practical	40/10/--/--

Course Objectives:

1. To learn special grades of steel.
2. To understand sources of inclusion.
3. To learn the various techniques of secondary steel making.

Course Outcomes (COs):

Course Outcomes (COs): Upon completion of this course, students will be able to		Mapping with PO's
CO 1	Students will able to differentiate the special grades of steel.	1
CO 2	Students will understand the importance of making clean steel.	1

Correlation matrix of Course outcomes with Programmed outcomes (CO-PO)
1=Low correlation, 2=Medium correlation, 3=High correlation

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	2	-	-	-	-	-	-	-	-	-	1
CO 2	2	-	-	-	-	-	-	-	-	-	1

Course contents:

Introduction- Special grade steels, development of secondary steel making and their importance, sources of inclusions, sulphur, phosphorous and gasses in steels, secondary steel making

technologies; Inert gas purging, vacuum degassing- deoxidation; ladle furnace; VOD- theory and practice; Powder injection system; physic chemical and fluid dynamic aspects of powder injection and stirring processes; role of slag and powders in inclusion control, Desulphurization and dephosphurization, cored wire feeding; Production of ultra low S, P and inclusion free steels, ultra low carbon steels; Raw materials for secondary steel making, addition of Ca-Si, ferro alloys etc in ladle lining, properties and selection of refractories.

TextBooks/ReferenceBooks/ OtherBooks/E-material/Paper

Sr. No	Title	Author	Publisher	Edition	YearofEdition
1	Introduction to Modern Steel Making	V.R. Tuppari			
2	Fundamentals of Steel Making	E.T. Turkdogan	The Institute of Materials, London		
3	The Making, Shaping and Treating of Steel		Steel Making and Refining	Vol.- AISE Steel Foundation, Pittsburg, USA	
4	Pinciples of Foundry Technology	P.L. Jain	Tata McGraw Hill		
5	Principles of Metal casting	R. Heine &Rosenthall	TMH		
6	ASM Metal Handbook			Vol.-4, Casting	
7	Foseco Ferrous Foundryman‟s Handbook	John R. Brown	Butterworth Heinemann Pub		
8	Foundry Technology	Peter Beeley	Butterworth Heinemann Pub.		

PAPER –XXII: QUALITY CONTROL

Course Type: Theory / Practical	Theory
Required/Elective	Required
Prerequisite	Basic Knowledge of production
Teaching Scheme (Lecture/Practical/Tutorial/Drawing)	03/00/00/00 Hours
Total contact Hours (Lecture/Practical/Tutorial/Drawing)	50/00/00/00 Hours
EvaluationScheme: Theory Theory Paper /Term Work/Oral/Practical	40/10/--/--

Course Objectives:

1. To learn various approaches of quality.
2. To understand different quality control policies.
3. To understand how to improve the quality using different quality tools.

4. To learn the statistical process control.
5. To learn the reliability.

Course Outcomes (COs):

Course Outcomes (COs): Upon completion of this course, students will be able to		Mapping with PO's
CO 1	Study various approaches of quality	3
CO 2	Understand kaizen, Deming and Juran's quality control policies.	3
CO 3	Study design of experiments using factorial approach and analyze the experiments.	3
CO 4	Discuss various quality improvement processes using charts, block diagram, distribution and QFD.	3
CO 5	Understand statistical processes control in quality and reliability assessment of product.	3
CO 6	Understand and apply Taguchi's experimental design for quality control.	3

Correlation matrix of Course outcomes with Programmed outcomes (CO-PO)
1=Low correlation, 2=Medium correlation, 3=High correlation

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	-	-	1	-	-	-	-	-	-	2	1
CO 2	-	-	1	-	-	-	-	-	-	2	1
CO 3	-	-	1	-	-	-	-	-	-	2	1
CO 4	-	-	1	-	-	-	-	-	-	2	1
CO 5	-	-	1	-	-	-	-	-	-	2	1
CO 6	-	-	1	-	-	-	-	-	-	2	1

Course contents:

1 Introduction: New culture of TQM, TQM axioms, consequences of total quality managing, cost of total quality, valuable tools for quality, the Japanese factor. The Deming Approach to management: Historical background, Deming's fourteen points for management, deadly sins & diseases, implementing the Deming's philosophy, Deming on management. Juran on Quality: Developing a habit of quality, Juran`s quality trilogy, the universal breakthrough sequence, Juran's Deming.

2. Crosby & the Quality Treatment: Crosby diagnosis of a troubled company, Crosby's quality vaccine, Crosby's absolutes for quality management, Crosby's fourteen steps for quality improvement. Imai`s Kaizen: The concept, Kaizen & innovation, the Kaizen management practices, Kaizen & Deming.

3.Basic Techniques for Statistical Analysis: Introduction, measures of central tendency & dispersion, confidence intervals, hypothesis testing, frequency distributions & histograms, probability distributions, measuring linear associations. Design & Analysis of Experiments:

Introductions, factorial experiments, aliasing, constructing fractional designs, analysis of variance.

4. Supporting of Quality Improvement Processes: Affinity diagram, bar chart, block diagram brain storming, cause and effect analysis, control charts, cost benefit analysis, customer-supplier relationship check list, decision analysis, flow charts, force field analysis, line graph/run charts, pareto analysis, quality costing, quality function development (QFD), quality project approach & problem solving process, risk analysis scatter diagrams, Weibull analysis, 6 Sigma.

5. Statistical Process Control: Introduction, data collection plan, variables charts, attributes, interpreting the control charts. Taguchi's Approach to Experimental Design & Offline Quality Control: Introduction, background to the method, Taguchi's recommended design techniques, from Deming to Taguchi & vice-versa.

TextBooks/ReferenceBooks/OtherBooks/E-material/Paper

Sr. No	Title	Author	Publisher	Edition	Year of Edition
1	Managing for Total Quality From Deming to Taguchi and SPC	N.Logothetis	Prentice Hall of India, New Delhi		2005
2	Designing for Quality	R.F.Lochner&J.E.Matar	Chapman & Hall		2001
3	Fundamental of Quality Control & Improvement	A.Mitra	Prentice Hall of India, New Delhi	2nd edition	2003
4	SPC:Concepts, Methodologies and Tools	A. Zaidi	Prentice Hall of India, New Delhi		1995

PAPER –XXIII: INDUSTRIAL MANAGEMENT

Course Type: Theory / Practical	Theory
Required/Elective	Required
Prerequisite	None
Teaching Scheme (Lecture/Practical/Tutorial/Drawing)	03/00/00/00 Hours
Total contact Hours (Lecture/Practical/Tutorial/Drawing)	50/00/00/00 Hours
Evaluation Scheme: Theory Theory Paper /Term Work/Oral/Practical	40/10/--/--

Course Objectives:

1. To understand the various functions of management.
2. To introduce various functional areas of marketing and material management.
3. To understand the various strategies of HR management.

Course Outcomes (COs):

Course Outcomes (COs): Upon completion of this course, students will be able to		Mapping with PO's
CO 1	Apply principles of management and carry out various functions of management.	9
CO 2	Analyze and select financial and marketing strategies of project.	9
CO 3	Apply various strategies of management for Human Resource Planning.	7,9

Correlation matrix of Course outcomes with Programmed outcomes (CO-PO)
1=Low correlation, 2=Medium correlation, 3=High correlation

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1									2	-	-
CO 2									2	-	-
CO 3							1		1	-	-

Course contents:

1. Functions of Management

Definition of Management, Management environment. Planning – Need, Objectives, Strategy, policies, Procedures, Steps in Planning, Decision making, Forecasting. Organizing – Process of Organizing importance and principle of organizing, departmentation, Organizational relationship, Authority, Responsibility, Delegation, Span of control. Staffing – Nature, Purpose, Scope, Human resource management, Policies, Recruitment procedure training and development, appraisal methods. Leading – Communication process, Barriers, remedies, motivation, importance, Theories.

2. Introduction to Marketing and Material Management

a) Marketing: Marketing Concepts –Objective –Types of markets – Market Segmentation, Market strategy – 4 AP‟s of market, Market Research, Salesmanship, Advertising. b) Materials Management: Definition, Scope, advantages of materials management, functions of materials management, c) Purchase Objectives, 5-R Principles of purchasing, Functions of Purchase

department, Purchasing cycle, Purchase policy & procedure, Evaluation of Purchase Performance.

3. Human Resource Development

Strategic importance HRM; objectives of HRM; challenges to HR professionals; role, Responsibilities and competencies of HR professionals; HR department operations; Human Resource Planning - objectives and process; human resource information system. Talent acquisition; recruitment and selection strategies, career planning and management, training and development, investment in training programme; executive development.

4. Introduction to E- Commerce

a) E-Commerce – Introduction to Management Information System (MIS), Introduction to ISO 9000 procedures. b) Industrial Safety – Reasons for accidents, prevention of accidents, Promotion of safety mindness.

Term work

Any three case studies on: Purchasing activities, Recruitment, Procedure, MIS, Management of funds, Office communication, Venture capital Funding.

Text Books/Reference Books/ Other Books/E-material/Paper

Sr. No	Title	Author	Publisher	Edition	YearofEditio n
1	Industrial Engineering and Management	O. P. Khanna	Dhanpatrai publications Ltd, New Delhi		
2	Industrial Management – I	L.C.Jhamb ,Savitri Jhamb	Everest Publishing House		
3	Global Management Solutions	Dinesh Seth and Subhash C. Rastogi	Cengage Learning, USA	2nd	
4	Management Information Systems	B. Davis and Margrethe H. Olson	Mc-Graw-Hill International Editions		
5	Strategic Management & Business Policy	AzarKazmi	Tata McGraw Hill, New Delhi		
6	Management Information Systems	Kenneth C. Laudon and Jane P. Laudon	Eighth Edition, Pearson Education		
7	Materialsand Logistics Management	K. ShridharaBhat	Himalaya Publishing House, Mumbai		
8	Financial Management	M.Y. Khan and P. K. Jain	Tata McGraw Hill, New Delhi		
9	Project Managem-ent	Ravi M. Kishore	Tata McGraw Hill, New Delhi		

Project Work-I

Students are allowed to select the topic of their project work subject to approval of the scope by the faculty. Maximum 4 students can work in group for a common topic. Students are expected to visit the site, shops, etc. They can discuss the topic with manufactures, owners, consultants. The project report comprising drawing, sketches, photographs and description must be elaborate to cover the topic in its entirety. The Drawing should specify sizing and the report should be hand written. The oral examination based on the project work submitted, shall be conducted in the presence of an external examiner.

Internship

Student need to complete his/her Internship for the span of three months from any reputed relevant industry. Student will get internship letter from the college and students need to submit the internship completion certification.

SEMESTER VI

PAPER - XXIV- WELDING AND SALVAGING PROCESSES

Course Type: Theory / Practical	Theory
Required/Elective	Required
Prerequisite	some knowledge about defetcs
Teaching Scheme (Lecture/Practical/Tutorial/Drawing)	03/00/00/00 Hours
Total contact Hours (Lecture/Practical/Tutorial/Drawing)	50/00/00/00 Hours
Evaluation Scheme: Theory Theory Paper /Term Work/Oral/Practical	40/10/--/--

Course Objectives:

1. To learn various types of welding processes.
2. To gain knowledge about selection of appropriate welding process.
3. To understand physical and metallurgical characteristics of weldments.
4. To know the concept of salvaging.

Course Outcomes (COs):

Course Outcomes (COs): Upon completion of this course, students will be able to		Mapping with PO's
CO 1	Demonstrate various welding processes.	1
CO 2	Select appropriate welding process according material specification.	1
CO 3	Salvage different components according to physical and metallurgical characteristics.	1

Correlation matrix of Course outcomes with Programmed outcomes (CO-PO)
1=Low correlation, 2=Medium correlation, 3=High correlation

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	1	-	-	-	-	-	-	-	-	-	-
CO 2	1	-	-	-	-	-	-	-	-	-	-
CO 3	1	-	-	-	-	-	-	-	-	-	-

Course contents:

Various welding processes suited to fabrication and repair of castings and forgings; weldability; welding energy sources and their characteristics; welding of various metals and alloys; Physical and metallurgical characteristics of weldments, testing and inspection of weldments; Salvaging of castings and forging. Types of methods of repairs; impregnation; metal spraying and other processes.

Text Books/Reference Books/ Other Books/E-material/Paper

Sr.No	Title	Author	Publisher	Edition	YearofEdition
1	Metallurgy of Welding	J. L. Lancaster	Woodhead Publishing Ltd.		
2	Metals and their Weldability	Welding HandbookPart-IV	American Welding Society		
3	Metallurgy of Welding	Porter & Stirling			
4	Physical Metallurgy-Vol I and II				
6	Metallurgy for Engineers	Clark and Varney			
7	Welding Technology & Design	V. M. Radhakrishnan	New Age International Publishers		
8	A Textbook of Welding Technology	O. P. Khanna			
9	Principles of Welding	R. W. Messler	John Wiley & Sons		

PAPER –XXV: ENERGY CONSERVATION AND POLLUTION CONTROL

Course Type: Theory / Practical	Theory
Required/Elective	Required
Prerequisite	Different casting processes
Teaching Scheme (Lecture/Practical/Tutorial/Drawing)	03/00/00/00 Hours
Total contact Hours (Lecture/Practical/Tutorial/Drawing)	50/00/00/00 Hours
EvaluationScheme: Theory Theory Paper /Term Work/Oral/Practical	40/10/--/--

Course Objectives:

1. To learn about various energy sources.
2. To generate awareness about energy conservation.
3. To Learn various aspects of pollution in foundries.

Course Outcomes (COs):

Course Outcomes (COs): Upon completion of this course, students will be able to		Mapping with PO's
CO 1	Select appropriate energy source including alternate energy sources.	4,5
CO 2	Apply and create energy conservation techniques.	4,5
CO 3	Design the procedure to control the pollution in foundries.	4,5

Correlation matrix of Course outcomes with Programmed outcomes (CO-PO)
1=Low correlation, 2=Medium correlation, 3=High correlation

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	-	-	-	1	3	-	-	-	-	1	-
CO 2	-	-	-	1	3	-	-	-	-	1	-
CO 3	-	-	-	1	3	-	-	-	-	1	-

Course contents:

Energy Conservation- Forms of energy, energy conservation, energy sources and resources, present and future energy demands; Review of commercial energies from solid, liquid and gaseous fuels. Nuclear energy systems, alternate energy sources; Improving energy efficiency in extractive metallurgical processes; Design and management of energy conservation; Recycling of energy, energy conservation techniques.

Pollution Control- Gas recovery in metal processing industries, gas cleaning and removal of particulate matter from gases; Heat exchangers and water cleaning of solids; Pollution control in specific metal process industries- Iron and steel, Cu, Ni, Pb, Zn, Al etc; Environmental considerations in metal casting, metal forming, metal plating and heat treatment industries

TextBooks/ReferenceBooks/ OtherBooks/E-material/Paper

Sr. No	Title	Author	Publisher	Edition	YearofEdition
1	Managing Industrial Pollution	S. C. Bhatia	Macmillan India Ltd.		

2	Environmental Principles and Policies	Sharon Beder			
3	Plant Engineers	Dennis A. Snow	Butterworth Hienemann		
4	Efficient use and Conservation of Energy Vol.1	Clark W. Gellings	Encyclopedia of Life Support Systems		
5	Energy Conservation through Control	Francis Shinskey	Elsevier Inc		
6	Energy Management and Conservation	K. V. Sharma			
7	Energy Conservation Act, 2001- Along with Allied rules		Universal Law Publication		

PAPER –XXVI: FRACTURE MECHANICS AND ANALYSIS OF FAILURE

Course Type: Theory / Practical	Theory
Required/Elective	Required
Prerequisite	Understanding of mechanical properties.
Teaching Scheme (Lecture/Practical/Tutorial/Drawing)	03/00/00/00 Hours
Total contact Hours (Lecture/Practical/Tutorial/Drawing)	50/00/00/00 Hours
EvaluationScheme: Theory Theory Paper /Term Work/Oral/Practical	40/10/--/--

Course Objectives:

1. To learn the concepts of fracture mechanics.
2. To understand various types of failure.
3. To learn the failure at different conditions.
4. To give different case studies of failures.

Course Outcomes (COs):

Course Outcomes (COs): Upon completion of this course, students will be able to		Mapping with PO's
CO 1	Apply the concepts of fracture mechanics.	1,3
CO 2	Analyze various types of failure at different condition.	1,3
CO 3	Evaluate different case studies of failures.	1,3

Correlation matrix of Course outcomes with Programmed outcomes (CO-PO)
1=Low correlation, 2=Medium correlation, 3=High correlation

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2
CO 1	1	-	1	-	-	-	-	-	-	2	-
CO 2	1	-	1	-	-	-	-	-	-	2	-
CO 3	1	-	1	-	-	-	-	-	-	2	-

Course contents:

Aims of failure analysis, Prime factors in the premature failure of metallic components and structures, Tools and techniques in failure analysis, Types of failures: ductile, brittle, fatigue, creep, corrosion, wear etc., fractography, mixed mode and fatigue failures, Failure mechanisms, Embrittlement phenomena, environmental effects, Failures due to faulty heat treatments, Failures in metal forming and welding, Case studies in failure analysis, Prevention of failures, case histories of component failures.

TextBooks/ReferenceBooks/ OtherBooks/E-material/Paper

Sr. No	Title	Author	Publisher	Edition	YearofEdition
1	Fracture Mechanics-Fundamentals and Applications	T. L. Anderson			
2	Fracture Mechanics	M. Janssen	Taylor and Francis Group		
3	Metal Fatigue Analysis Handbook	Yung Li Lee, Mark Barkey	Butterworth Hienemann Pub		
4	Fatigue of Materials	S. Suresh	Cambridge University		
5	Applied Fracture Mechanics	Alexander Belov	Intech Pub.		
6	Fatigue Failure of Metals	S. Kocanda	Slithoff&Noordhoff International Pub		
7	Smithells Metals Reference Books	W. F. Gale	Elsevier Pub.		

Project Work-II

Students are allowed to select the topic of their project work subject to approval of the scope by the faculty. Maximum 4 students can work in group for a common topic. Students are expected to visit the site, shops, etc. They can discuss the topic with manufactures, owners, consultants. The project report comprising drawing, sketches, photographs and description must be elaborate to cover the topic in its entirety. The Drawing should specify sizing and the report should be

hand written. The oral examination based on the project work submitted, shall be conducted in the presence of an external examiner.

List of Experiments

Semester V

Part-I:CADCAM	
Sr. No	**Name of Experiment**
1	Prepare 2D model using CAD software
2	Prepare 3D model (use any3D modeling software)
3	Simulate the metal flow (Use casting simulation software)
Part-II:CASTING DEFECTS	
1	Description of defect : Burnt-on sand
2	Description of defect: Cores and edge disintegration
3	Description of defect: Erosion
4	Description of defect: Explosive penetration
5	Description of defect: Lustrous carbon inclusion
6	Description of defect: Graphite degeneration
7	Description of defect: Fissure defect
8	Description of defect: Pitted surface
9	Description of defect: Penetration
10	Description of defect: Surface blow hole
11	Description of defect: Pin hole
12	Description of defect: Sand inclusion
13	Description of defect: Surface roughness
14	Description of defect: Scabbing
15	Description of defect: Swelling
16	Description of defect: Penetration due to chemical reaction

Semester VI

Sr. No	Name of Experiment
1	Salt spray (Fog chamber) test
2	Humidity Resistance test

3	Heat resistance test of paints
4	Portable hardness test
5	Adhesion test of paint
6	Replica method to determine microstructure
7	Crack detection of metal using ultrasonic crack detection machine
8	Crack detection of metal using magnetic particle inspection
9	Surface crack detection using dye penetrant testing