SHIVAJI UNIVERSITY KOLHAPUR

Foundry Technology

Syllabus

For

B. Voc. Part-II (Foundry Technology)

Advanced Diploma in Foundry Technology

To be implemented from Academic Year 2015-2016 onwards

STRUCTURE OF SYLLABUS:

To be implemented from the academic year 2015-2016

1. Title of the course: ADVANCED DIPLOMA 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 - Advanced Diploma in Foundry Technology

•B.Voc. Part III - Bachelor of Vocation 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.

7. Eligibility:

1. Candidate should be passed Diploma in **'Foundry Technlogy**'
2. Candidates having Diploma in '**Cast Iron Foundry Technology**' are also eligible.
3. Candidates with Diploma in '**Casting Development and Quality Assurance**' are also eligible for the advanced diploma 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 five theory papers. **Practical Examination will be conducted at the end of every semester.**

For Semester I

Paper Number	Title of Paper	Total Marks	Credits
I	Fundamentals of Financial Accounting-I	50	3
II	Physical Metallurgy-I	50	2
III	Machine Drawing	50	2
IV	Fuels, Furnaces and refractories	50	2
V	Iron Casting Production	50	2
	TOTAL	250	11

For Semester II

Paper Number	Title of Paper	Total Marks	Credits
I	Fundamentals of Financial Accounting-II	50	3
II	Physical Metallurgy-II	50	2
III	Steel Casting Production	50	2
IV	Non-Ferrous Casting Production	50	2
V	Testing and Inspection Techniques	50	2
	TOTAL	250	11

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	Credits
1	Theory Examination 50 X 5	250	11
2	Practical Examination.	150	14
3	Internal Assessment	50	5
	TOTAL	**450**	**30**

B. Nature of question paper:

For the **papers II to V** there will be in all **SEVEN** questions in each paper of which any **FIVE** should be solved. All questions will carry equal marks i.e. each question will be of 10 marks.

General nature of the question paper will be:

Question Number	Type	
Q.1	Short answer	Any two out of three
Q.2,3,4,5,6	Long answer	No internal options.
Q.7	Short notes	Any two out of three

C. Standard of Passing:

To pass the examination a candidate must obtain at least 35% (i.e 18 marks out of 50) 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 second year i.e. Advanced Diploma 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. II, III, IV and V. The practical batch will have 20 students.

The total workload for one batch will be:

1. **One Paper** on General Education:	=	**06** Theory Periods.
2. **Four Papers** on skill based Education: 4 X 3	=	**12** Theory Periods.
3. **Four Practical** work per week: 4 X 4	=	**16** Practical periods.
4. **Project Work** per batch per week:	=	**02** Periods.

	TOTAL	**36 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 Date 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.

B.Voc. Part-II (Advanced Diploma in Foundry Technology)
Course structure

General Structure:

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

SEMESTER – I

1) Paper-I: Fundamentals of Financial Accounting-I - 50 Marks.
2) Paper-II: Physical Metallurgy-I - 50 Marks.
3) Paper-III: Machine Drawing - 50 Marks.
4) Paper-IV: Fuels, Furnaces and refractories - 50 Marks.
5) Paper-V: Iron Casting Production - 50 Marks.

SEMESTER – II

1) Paper-VI: Fundamentals of Financial Accounting-II - 50 Marks.
2) Paper-VII: Physical Metallurgy-II - 50 Marks.
3) Paper-VIII: Steel Casting Production - 50 Marks.
3) Paper-IX: Non-Ferrous Casting Production - 50 Marks.
4) Paper-X: Testing and Inspection Techniques - 50 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.

ADVANCE DIPLOMA IN FOUNDRY TECHNOLOGY

SEMESTER III

GENERAL EDUCATION:

Paper I: FUNDAMENTALS OF FINANCIAL ACCOUNTING-I

Work Load - 6 | Total Marks – 50

Theory – 4 Lectures / Week | Theory- 40
Practical- 2 Lectures / Week | Practical- 10

Objective : To impart basic accounting knowledge as applicable to business.

Course contents:

Unit I : Introduction to Accounting
Meaning, Nature and Advantages of Accounting, Branches of Accounting, Accounting Concepts and Conventions, Types of Accounts, Rules of journalizing, Source Documents – Cash Voucher, Petty Cash Voucher, Cash Memo – Receipts, Debit Notes, Credit Note, Paying Slips, Withdrawals, Cheque

Unit II : Journal and Ledger
Preparation of Journal entries and Ledger accounts – Subsidiary Books - Purchase Book, Purchase Return Book, Sales Book, Sales Return Book, Cash Book, Bills Receivable Book, Bills Payable Book, Journal Proper

Unit III : **Depreciation**
Meaning, Methods – Straight Line Method – Reducing Balance Method, Change in Depreciation Method.

Unit IV: Final Accounts
Preparation of Trial Balance, Preparation of Final Accounts of Sole Traders and partnership firms

Practical:

1) Preparation of Journal entries and Ledger accounts
2) Preparation of subsidiary books
3) Preparation of Trial Balance
4) Practical problems on Final Accounts of sole traders and partnership firms
5) Practical problems on methods of depreciation

Scheme of Internal Practical Evaluation **10 Marks**

1) Submission of Record Book 5 Marks
2) Viva – Voce 5 Marks

References:

1) Advanced Accountancy – M.C. Shukla and T.S. Garewal.
2) Advanced Accountancy – S.C. Jain and K. L. Narang
3) Advanced Accountancy – S.M. Shukla.
4) Advanced Accountancy – S. N. Maheshwari.
5) Advanced Accountancy – R. L. Gupta.

SKILL BASED PAPERS:

Paper –II: Physical Metallurgy-I

1.0 **Crystallography** **10 Hrs.**

Crystal structures, Bravais lattice, crystal structures in metals and alloys-BCC, FCC, HCP; Miller indices for planes and directions, average no of atoms, co ordination number and APF;

2.0 **Crystallization** **10 Hrs.**

Process of solidification- nucleation and growth- critical nucleus size; Cooling curves for metals and alloys, Gibbs phase rule; Equilibrium diagrams-

3.0 **Equilibrium Diagrams** **10 Hrs.**

To draw equilibrium diagrams using cooling curves, Equilibrium diagram types-Eutectic, peritectic systems, etc; Types of phases- so0lid solutions, types and properties ,intermetallic compounds and intermediate phases; long range and short range freezing alloys- coring and dendritic structures;

4.0 **Iron-Iron carbon equilibrium diagram** **10 Hrs.**

Phases, compositions, temperatures; study of effect of alloying elements on iron-iron carbon diagram;

5.0 **Non ferrous equilibrium diagrams** **10 Hrs.**

Equilibrium diagrams of Aluminum alloys, copper alloys, magnesium alloys, tin alloys.

Reference Books:

1. Introduction to Physical Metallurgy- Sidney H Avner- Tata McGraw Hill
2. Applied metallurgy - S. Burton
3. Material Science and Metallurgy- V.D. Kodgire
4. Physical Metallurgy- Vijendra Singh- Standard Publishers and Distributors, New Delhi
5. Physical Metallurgy- Vol I and II
6. Metallurgy for Engineers- Clark and Varney

Paper –III: Machine Drawing

1.0 Principles of drawings : **15 Hrs.**

classification of drawings, review of drawing sheet sizes & layout recommended by BIS, types of lines, scales used in engineering drawing, sections, types of sections, conventional representation of engineering materials and machine components, methods of dimensioning, symbolic representations of welds and surface finish

2.0 Sketching of machine components: **15 Hrs.**

Screw thread terminology, forms of threads, conventional representation of threads, multiple start threads, RH & LH threads, type of nuts and bolts, washers, locking arrangements for nuts, foundation bolts, types of keys, cotter joint and knuckle joints, rigid coupling, flange coupling & flexible coupling, flat and V belt pulleys, sliding and rolling contact bearings: journal bearing, bush bearing, pedestal bearing, pivot bearing, ball & roller bearings

3.0 Gear drives : **10 Hrs.**

Gear Terminology, introduction to spur gear, helical gear, bevel gear, wom& worm wheel, gear materials, forms of teeth, advantages & disadvantages

4.0 Elements of Production Drawings: **10 Hrs.**

Limits fits & tolerances- significance, types and selections, hole basis & shaft basis system, Surface roughness- terminology symbols, characteristics, representation of elements on production drawings.

Drawing Sheets: 6 drawing Sheets based on above topics

Reference Books:

1. Gill P.S., "Engineering drawing", S.K.Kataria& Sons.
2. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
3.0 BasantAgarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawingsheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Paper –IV: Fuels, Furnaces and refractories

1.0 Classification of fuels **8 Hrs.**

Solid liquid and gaseous, natural and synthetic liquid fuels, their advantages and limitations.

2.0 Principles of combustion **7 Hrs.**

Calorific value, speed and combustion, requirements of air, or oxygen, properties of flames, combustion problems, non conventional energy.

3.0 Furnaces **20 Hrs.**

Classification of furnaces based on heating methods and refractories used, basic principles of fuel fired, resistance, induction and arc furnaces, furnace lining, furnace atmospheres, furnace efficiency.

4.0 Refractories **15 Hrs.**

Classification of refractories, their properties and uses in foundry industries.

Reference Books:

1. Industrial Furnaces- Trinks, Mawhinney, Shannon, Reed and Garvey- J.R. Publishers
2. Principles of Metal casting - R. Heine & Rosenthall, TMH
3. Refractories and Furnaces- Francis Thompson Havard- McGraw Hill

Paper –V: Iron Casting Production

1.0 Introduction of Cast Iron **10 Hrs.**

Significance of carbon equivalent, solidification of grey and S.G. Iron, states of graphitization, effect of alloying elements;

2.0 Classification of Cast Iron **10 Hrs.**

Properties and applications of grey and S.G. Iron; Melting units for production of cast iron and melt quality control test;

3.0 Treatments of Cast Iron **10 Hrs.**

Inoculation, desulphurization and Mg treatment methods for production of S.G. Iron production; Production of compacted graphite iron;

4.0 Methoding of Cast Iron **10 Hrs.**

Molding and core making processes for cast iron; gating and feeding practices for cast iron

5.0 Defects of Cast Iron **10 Hrs.**

Casting defects and analysis of defects of different grades of cast iron.

Reference Books:

1. Metal Casting Principles and Practice- T.V. RamanaRao- New Age International Publishers
2. Pinciples of Foundry Technology–P.L. Jain- Tata McGraw Hill
3. Principles of Metal casting - R. Heine &Rosenthall, TMH
4. Modern Iron Making- V.R. Tuppari
5. Principles of Blast Furnace Iron Making: Theory and Practice- A.K. Biswas- SBA Publication
6. Castings- John Campbell- Elsevier, 2004
7. Principal of foundry technology- P. L. Jain- Tata McGraw Hill
8. ASM Metal Handbook- Vol.-4, Casting
9. Foseco Ferrous Foundryman's Handbook- John R. Brown- Butterworth Heinemann Pub.
10. Foundry Technology- Peter Beeley- Butterworth Heinemann Pub.

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.

SEMESTER IV

Paper I-FUNDAMENTALS OF FIANACIAL ACCOUNTING- II

Work Load - 6 | Total Marks – 50

Theory – 4 Lectures / Week | Theory- 40
Practical- 2 Lectures / Week | Practical- 10

Objectives: To impact basic accounting knowledge as applicable to business.

Course contents:

Unit I **Computerized Accounting System**
Introduction – Concept – Components –Features - Importance and Utilization of Computerized Accounting System.

Unit II **Computer Application through Accounting Package Tally**
Creation of Company, Group, Ledger Accounts, Feeding of Accounting Data Receipts, Payments, Purchase, Sale, Contra, Journal, Credit Note and Debit NoteInventory Information – Groups, Items and Valuation.
Generation of various Accounting Reports.

Unit III **Accounts of Professionals**
Preparation of Receipts and Payment Account – Income and Expenditure Account and Balance Sheets of Non Profit Organization.

Unit IV **Single Entry System**
Conversion of Single Entry System into Double Entry System.

Practical:

1. Understanding computerized accounting practices applied in different retail malls in and around Kolhapur city
2. Practical problems based on computerized accounting using Tally
3. Practical problems on preparation of Receipts and Payment Account
4. Preparation of Income and Expenditure account and Balance Sheet of Non-profit making organizations
5. Solving the problems on conversion of Single Entry system into Double entry system.
6. Oral / Seminar

References:

1. Advanced Accountancy, M. C. Shukla and T. S. Garewal.
2. Advanced Accountancy, S.C. Jain and K. L. Narang.
3. Advanced Accountancy, S.N. Maheshwari.
4. Theory and practice of Computer Accounting, Rajan Chougule and Dhaval Chougule.

Web sites:

1) www.nos.org
2) www.wiki.answers.com
3) Chow.com

Scheme of External Practical Examination **10 marks**

1) Submission of Record book 5 marks
2) Viva – Voce 5 marks

Paper –II: Physical Metallurgy-II

1.0 Principles of heat treatment **05 Hrs.**

Definition and basic requirements for alloys to be heat treated, heat treatability; advantages and purposes of heat treatment

2.0 Transformations of pearlite and austenite **05 Hrs.**

Transformation of pearlite to austenite upon heating, mechanism and kinetics of transformation, austenite grain size;Transformation of austenite to pearlite, upper and lower bainite and martensite upon cooling-mechanism and kinetics of transformation;

3.0 TTT diagrams **05 Hrs.**

Construction of TTT diagram, effect of carbon percentage and alloying element on TTT diagram, uses and significance of TTT diagrams; CCT diagrams- Construction and significance;

4.0 Annealing and Normalizing **05 Hrs.**

Process parameters, types, effect on structure, properties and applications. Hardening-process parameters, relation of temperature and time on hardness;

5.0 Quenching **05 Hrs.**

Quenching media, mechanism of quenching; Hardenability, Hardenability test; Tempering-purpose, types, transformations during tempering, applications;

6.0 Surface hardening **05 Hrs.**

Principle, purposes and types; Flame hardening, Induction hardening- Types, process control, case depth obtained, advantages, limitations and applications; Case Hardening- Carburizing, Nitriding, Carbonitriding- process control, case depth obtained, advantages, limitations and applications;

7.0 Heat treatment for Cast Iron **05 Hrs.**

Annealing, Stress relieving, Quenching, Tempering- Process parameters, advantages, limitations and applications.

8.0. Heat treatment for non ferrous alloys **05 Hrs.**

Homogenization annealing, stress relief annealing, recrystallization annealing;

9.0 Precipitation Hardening **05 Hrs.**

Basic requirement of alloys, mechanism, structural transformations, precipitation hardenable alloys, effect of temperature, time on precipitation hardening.

10.0 Heat treatment furnaces **05 Hrs.**

Classification based on fuel used, furnace atmospheres, Batch type, continuous type; Heat treatment defects-oxidation, decarburization, low strength and hardness, cracks and distortion-causes and remedies; Energy economy- Need and significance- methods of energy economy.

Reference Books:

1. Principles of Heat Treatment- Rajan Sharma
2. Introduction to Physical Metallurgy- Sidney H Avner- Tata McGraw Hill
3. Applied metallurgy - S. Burton
4. Material Science and Metallurgy- V.D. Kodgire
5. Physical Metallurgy- Vijendra Singh- Standard Publishers and Distributors, New Delhi
6. Physical Metallurgy- Vol I and II
7. Metallurgy for Engineers- Clark and Varney
8. ASM Metal Handbook- Vol.-4, Heat Treating
9. Steel Heat Treatment Handbook- George E. Totten- Taylor and Francis Pub.

Paper –III: Steel Casting Production

1.0 Introduction to Steels **10 Hrs.**

Classification, properties and applications of carbon and alloy steels,

2.0 Melting and Solidification of steel **10 Hrs.**

Solidification mechanism, Melting of carbon and alloy steels in electric arc and induction furnaces,

3.0 Basic Practices and Reactions of Steel **10 Hrs.**

Acid and basic practices, oxidation and refining, fluxing; Sulphur and phosphorous removal, de-oxidation, methods of degassing, tapping and pouring,

4.0 MethodingFor Steel **10 Hrs.**

Gating and feeding practices; mould and core making practice for steel, fettling and salvaging for steel castings,

5.0 Heat treatment for steel castings. **10 Hrs.**

Reference Books:

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 –IV: Non-Ferrous Casting Production

1.0 Introduction to Non Ferrous Alloys **10 Hrs.**

Composition, solidification, structure, properties and applications of aluminum, magnesium, copper and zinc based alloys;

2.0 Melting and Solidification of Non Ferrous alloys **10 Hrs.**

Charge calculations, hardeners; oxidation and gas absorption in non ferrous alloys, detection of gasses;

3.0 Basic Practices and Reactions of Non Ferrous alloys **10 Hrs.**

Melting, fluxing, degassing and pouring practices, filtration of non ferrous melt; melt treatment for alloying modification and grain refinement;

4.0 Methoding For Non Ferrous alloys **10 Hrs.**

Mould and core practices, metal mould reaction, gating and feeding practices for non ferrous alloy castings;

5.0 Defects and defect analysis of Non Ferrous Alloys **10 Hrs.**

Defect analysis, salvaging of non ferrous alloy castings.

Reference Books:

1. Metal Casting Principles and Practice- T.V. RamanaRao- New Age International Publishers
2. Pinciples of Foundry Technology–P.L. Jain- Tata McGraw Hill
3. Principles of Metal casting - R. Heine &Rosenthall, TMH
4. Fundamental of metal casting -P.C.Mukherji
5. Metal Casting Technology - P.C. Mukherjee, Oxford & IBH
6. ASM Metal Handbook- Vol.-4, Casting
7. Foseco Non-Ferrous Foundryman's Handbook- John R. Brown- Butterworth Heinemann Pub.
8. Foundry Technology- Peter Beeley- Butterworth Heinemann Pub.

Paper –V: Testing and Inspection Techniques

1.0 Introduction to Foundry Testing **10 Hrs.**

Classification of various tests on the basis of type and rate of loading; Principles of different tests- tensile, compression, hardness, impact;

2.0 Non Destructive Testing **10 Hrs.**

Principles, classification of testing techniques, merits, demerits and field of applications of various non destructive tests- visual inspection, radiography, ultrasonic, magnetic particle, eddy current, dye penetrant;

3.0 Optical Metallography techniques **10 Hrs.**

Principles, methoding, applications;

4.0 Electron Microscopy **10 Hrs.**

Scanning Electron Microscopy, Transmission Electron Microscopy;

5.0 Spectroscopy Techniques **10 Hrs.**

Optical emission spectrometer, Atomic absorption spectroscopy, Infrared Spectroscopy, X-Ray Spectroscopy

Reference Books:

1. Characterization of Materials- Kauffmann- John Wiley Publications
2. Materials Characterization- ASM Metal Handbook- Vol.-10- ASM Int. 2004
3. Non Destructive Testing and Quality Control- ASM Metals Handbook- Vol.-17- ASM Int.
4. Non destructive Testing Hand Book- P. McIntire (Ed.)-Vol.-4- American Society for non destructive Society, 1986.
5. Nondestructive Evaluation: Theory, Techniques and Applications- Peter J. Shull- Marcel Dekkar, 2002
6. Physical Methods for Metal Characterization- PejFlewitt- Institute of Physicas Publications
7. Testing and Inspection of Engineering Materials- Davis, Troxell and Wiskonell- McGraw Hill

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.

SUGGESTED LIST OF PRATICALS:

For each semester, at least 15 practicals related with the theory subjects should be taken. Some of the practicals are suggested below.

1. Study of different melting units (furnace) present in the laboratory/industry.

2. Testing of moulding and core sand. Sand testing experiments to determine:

• Grain Fineness Number

• Green Strength

• Permeability Test

• Moisture content test

3. Demonstration of die casting, centrifugal casting process.

4. Study, understanding and working of simple destructive & non-destructive testing Procedures used for castings.

5. Visit to foundry to study foundry processes like furnace operations, pattern making and moulding. Study of automation processes, Layout, Material handling equipment & other processes with preparation of report.

6. Melting of metal in furnace. Study of Oil Fired furnace, Gas Fired furnace, Electrical Heating furnace, Rotary Furnace.

7. Study of Medium Frequency Induction Furnace (Coreless) detailing regarding lining material and crucibles.

8. Study of Vacuum Induction Melting Furnace.

9. Study of Holding Furnace (Indirect Heating)

10. Study of various types of gates.

11. Study of various types of risers.

12. Case study of design of gating system and riser

13. Study of various methods of the S.G.Iron production.

14. Crucible Melting of Al

15. Study of the modification of the Al-Si. Alloys.

16. Foundry practice for Aluminum alloys.

17. Production of Cu and Cu alloy castings

18. Production of Mg &Zn base casting alloys.

INDUSTRIAL TRAINING:

The purpose of industrial training is to offer wide range of practical exposures to latest practices, equipment and techniques used in the field. This training programme will help the student in acquiring hands on experiences of various practices and events required to perform in different job situations. Through the industrial training the students are given an opportunity to develop psychomotor skills and problem solving ability.

The industrial Training has basically the followingthree components:

1. Orientation Programme

2. Industrial Training in the Industry

3. Report Writing and Evaluation

General Objectives: The student will be able to**,**

• Read and Interpret Drawing

• Observe different types of processes in ferrous / non-ferrous foundry.

• Study and develop methoding of casting.

• Identify casting defects and provides remedies.

• Study the available manuals.

• Develop history sheet for various processes/product.

Activities to be carried out during training:

1. Student should visit each section of the foundry/foundry department

2. Observe the processes, tools, machinery and equipment used

3. Observe testing of castings at each stage

4. Study drawings and interpret the drawings

5. Study the organisational structure of the company

6. Study the product development from raw material to finished goods

7. Observe safety norms adopted

8. Prepare a report on a case study which includes all the components referred above.

Training Report:

The students will have to go for industrial training in all the sections of foundry. After training the student is required to prepare a report on the following points:

• Details of the industry

• Layout of the foundry- different sections

• List of equipments in each section

- Organizational structure of the industry
- Description of major processes
- Quality measures adopted in the industry
- Safety norms and there implementation
- One detailed case study- from component drawing to finished casting.