SHIVAJI UNIVERSITY KOLHAPUR

Ad-hoc Board in Foundry Technology

Syllabus

For

B. Voc. Part-III (Foundry Technology)

B.Voc Degree in Foundry Technology

To be implemented from Academic Year 2016-2017 onwards

STRUCTURE OF SYLLABUS:

To be implemented from the academic year 2016-2017

1. Title of the course: Bachelor of Vocation (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 - 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 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 thesyllabus.

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

For Semester V

Paper Number	Title of Paper	Total Marks	Credits
I	Secondary Steel Making	50	3
II	Process Modeling and Computer Applications in Foundry	50	3
III	Industrial Management for Foundry	50	3
TOTAL		150	09

For Semester VI

Paper Number	Title of Paper	Total Marks	Credits
I	Welding and Salvaging Processes	50	3
II	Energy Conservation and Pollution Control	50	3
III	Fracture Mechanics and analysis of Failure	50	3
TOTAL		150	09

The practical examination will be of 300 marks for **each semester**.

Sr. No.	Practical examination	Marks	Internal Assessment	Marks
1	Practical	180	Project Work / Industry Training.	100
2	Journal	10		
3	Oral	10		
Total		200		100

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 3	150	09
2	Practical Examination.	200	14
3	Internal Assessment	100	6
	TOTAL	**450**	**30**

B. Nature of question paper:

For all the **papers I to III** 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

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 BrinellHardness 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. **Three Papers** on skill based Education: 3 X 3	=	**09** Theory Periods.
3. **Four Practical** work per week: 4 X 4	=	**16** Practical periods.
4. **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 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-III (Bachelor of Vocation in Foundry Technology)
Course structure

General Structure:

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

SEMESTER – V

1) Paper-I:Secondary Steel Making - 50 Marks.
2) Paper-II:Process Modeling and Computer Applications in Foundry - 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.
3) 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 200 marks of which 20 marks are reserved for oral and journal. The internal assessment of 100 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.

BACHELOR OF VOCATION IN FOUNDRY TECHNOLOGY

SEMESTER V

SKILL BASED PAPERS:

Paper I: Secondary Steel making

Theory – 3 Lectures / Week
Total Marks – 50

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.

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 –II:Process Modeling and computer applications in Foundry

Theory – 3 Lectures / Week
Total Marks – 50

Introduction to 2D drawing, 2D modeling using AutoCAD software, Principles of model development, Introduction to 3D modeling; 3D modeling of molds & forging dies using solid modeler; simulation and analysis of close die forging of forged components such as gear blank using FEM based software packages. Simulation of metal flow in moulds, effect of methoding practices on solidification in castings using industry standard FEM based software packages. Case studies.

References:

1. CAD-CAM Principles & Applications- Groover
2. Computer Aided Design and Manufacturing - Paperback
3. Computer Aided Graphics and Product modeling- Pande
4. CAD CAM Automation- Farandak Haidri- Nirali Publication
5. Drawing for Product Designer- Kevin Henry
6. CAD CAM Concept & Application- Allava Chankeshwara
7. Mastering CAD CAM- Ibrahim Zaidi
8. Design Principles of 2D Design- Wuis Wong
9. 3D CAD with Autodesk- Emily Gurtz
10. CAD CAM Application Technology- Zhong Fu Ping
11. CAD IT CAM IT- Computer Aided Design Making

Paper –III:Industrial Management

Theory – 3 Lectures / Week
Total Marks – 50

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. Quality Management

Definition of quality, goalpost view of quality, continuous improvement definition of quality, types of quality – quality of design, conformance and performance, phases of quality management, Juran's and Demings view of quality, Quality Management Assistance Tools: Ishikawa diagram – Pareto Analysis – Pokka Yoke (Mistake Proofing).quality circles, TQM, Kaizen, Five S (5S), Six sigma Quality Management Standards (Introductory aspects only)- The ISO 9001:2000 Quality Management System Standard- The ISO 14001:2004 Environmental Management System Standard- ISO 27001:2005 Information Security Management System

4. 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.

5. EDP and SSI

Concept of an entrepreneur. Charms of being an entrepreneur. Entrepreneurship development SSI: Definition of SSI, Procedure to start Small Scale Industry. Institutions of offering assistance to SSI, Incentives offered to SSI, Problems of SSI, Feasibility report writing. Introduction to Venture Capital funding.

6. 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:

1. O. P. Khanna, "Industrial Engineering and Management", Dhanpatrai publications Ltd, New Delhi.

2. L.C.Jhamb ,Savitri Jhamb , Industrial Management – I , Everest Publishing House .

Reference Books :

3. Dinesh Seth and Subhash C. Rastogi, “Global Management Solutions”, Cengage Learning, Second Edition, USA.

4. B. Davis and Margrethe H. Olson, "Management Information Systems", Mc-Graw-Hill International Editions.

5. AzarKazmi , “Strategic Management & Business Policy “, Tata McGraw Hill, New Delhi

6. Kenneth C. Laudon and Jane P. Laudon, “"Management Information Systems", Eighth Edition, Pearson Education

7. K. ShridharaBhat, “Materials and Logistics Management”, Himalaya Publishing House, Mumbai

8. M.Y. Khan and P. K. Jain, “Financial Management”, Tata McGraw Hill, New Delhi

9. Ravi M. Kishore, “Project Managem-ent”, Tata McGraw Hill, New Delhi.

Project Work-I

Internal Assessment- – 100 Marks

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 VI

Paper I-Welding and Salvaging Processes

Theory – 3 Lectures / Week
Total Marks –

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.

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Reference Books:

1. Welding Handbook-American Welding Society, Part-I- Fundamentals of Welding
2. Metallurgy of Welding – J. L. Lancaster- Woodhead Publishing Ltd.
3. Metals and their Weldability- Welding Handbook, Part-IV- American Welding Society
4. Metallurgy of Welding- Porter & Stirling
5. 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 –II:Energy Conservation and Pollution Control

Theory – 3 Lectures / Week
Total Marks – 50

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

Reference Books:

1. Managing Industrial Pollution- S. C. Bhatia- Macmillan India Ltd.
2. Environmental Principles and Policies- Sharon Beder
3. Plant Engineers Reference Book-Dennis A. Snow- Butterworth Hienemann Pub.
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- Paperback
7. Energy Conservation Act, 2001- Along with Allied rules- Universal Law Publication.

Paper –III:Fracture Mechanics and analysis of failure

Theory – 3 Lectures / Week
Total Marks – 50

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.

Reference Books:

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

Internal Assessment- – 100 Marks

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. Specimen preparation techniques for different Destructive and Non-Destructive testing methods as follows-

- Tensile testing
- Charpy Impact testing
- Microstructural Evaluation
- Rockwell, Brinell, Micro-Vickers Hardness Testing.

2. Study and use of Universal Testing Machine

3. Study and use of ASTM Charpy Impact Testing.

4. Study and use of Metallurgical Microscope.

5. Microstructural study of Cast Iron.

6. Microstructural study of Steel and Stainless Steel.

7. Microstructural study of Non Ferrous alloys.

8. Study and use of Rockwell Hardness Test.

9.Study and use of Brinell Hardness Test

10. Study and use of Micro-Vickers Hardness Test

11. Study of Vacuum Induction Melting Furnace.

12. Study of Salt Spray test of Corrosion analysis.

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 following three 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.