# 9. RESOURCE REQUIREMENTS

## 9.1 Physical Resources

### 9.1.1 Equipment Requirement:

| Sr. No. | Description | Qty | Total Price (Rs) |
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| **CARPENTRY SHOP** | | | |
| 1 | Work benches fitted with carpenter vices | 5 | 20,000 |
| 2. | Circular saw grinder | 1 | 6,000 |
| 3. | Wood cutting band saw-vertical | 1 | 10,000 |
| 4. | Bench grinder | 1 | 5,000 |
| 5. | Drilling machine | 1 | 8,000 |
| 6. | Wood turning lathe | 1 | 40,000 |
| 7. | Wood Planner | 1 | 20,000 |
| 8. | Tool accessories measuring and marking Instruments | 25 | 25,000 |
| 9. | Band saw blade brazing unit | 1 | 10,000 |
| **FITTING AND PLUMBING SHOP** | | | |
| 1. | Work benches with vices (4 vices on each bench) | 5 | 30,000 |
| 2. | Marking tables with scribers | 4 | 24,000 |
| 3. | Surface plates | 5 | 20,000 |
| 4. | Bench grinders | 1 | 6,000 |
| 5. | Drilling machine | 2 | 12,000 |
| 6. | Power Hacksaw | 1 | 20,000 |
| 7. | Sheet Bending Machine | 1 | 40,000 |
| 8. | Tool kits – taps, dies, drills | 25 | 40,000 |
| 9. | Tool kits – chiesels, hammers, files, hacksaw | 25 | 25,000 |
| 10. | Accessories like calipers, V blocks, height, gauges steel rules and scribers | 25 | 50,000 |
| 11. | Pipe vice | 4 | 1,000 |
| 12. | Chain wrenches | 5 | 1,250 |
| 13. | Ring spanner set | 5 | 600 |
| 14. | Pipe die set 2” | 2 set | 1,000 |

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| 15. | Pipe bending device | 1 | 5,000 |
| 16. | Various pluming fitting | LS | 2,000 |
| **FOUNDRY SHOP** | | | |
| 1. | Moulding boxes | 40 | 8,000 |
| 2. | Ladles | 5 | 2,000 |
| 3. | Tool Kits | 10 set | 5,000 |
| 4. | Quenching tanks | 2 | 5,000 |
| 5. | Portable grinder | 1 | 3,000 |
| 6. | Pit furnace with blower | 1 | 10,000 |
| **PAINT SHOP** | | | |
| 1. | Spray gun with hose pine | 1 | 1,000 |
| 2. | Paint brushes | 20 | 2,000 |
| 3. | Paint/Varnish | LS | 2,000 |
| 4. | Air Compressor with 2 hp motor | 1 set | 10,000 |
| 5. | Miscellaneous | LS | 5,000 |
| **SMITHY SHOP** | | | |
| 1. | Blacksmithy forge (with open hearths, accessories to match the forge) | 20 | 40,000 |
| 2. | Wrought iron anvils | 20 | 20,000 |
| 3. | Swage blocks | 4 | 8,000 |
| 4. | Blower with accessories, motor switch etc | 1 | 6,000 |
| 5. | Work benches with vices | 2 | 6,000 |
| 6. | Power hammer | 1 | 20,000 |
| 7. | Tools and accessories – hammers, swages, tongs, pokers, pullers etc | 20 | 10,000 |
| **WELDING SHOP** | | | |
| 1. | Electrical welding transformer set with accessories | 3 | 30,000 |
| 2. | Gas Cutting Unit | 1 | 3,000 |
| 3. | Work benches with vices | 3 | 5,000 |
| 4. | Welding generator set | 1 | 10,000 |
| 5. | Oxy acetylene welding set with accessories | 1 | 7,000 |
| 6. | Acetylene generating set | 1 | 6,000 |
| 7. | Electric welder tool kit | 10 | 10,000 |
| 8. | Projection welding machine | 1 | 15,000 |
| 9. | Brazing equipment with accessories | 1 | 10,000 |
| 10. | Soldering irons | 3 | 1,000 |

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| 11. | Pedestal grinder | 1 | 10,000 |
| 12. | Metal spraying gun | 1 | 10,000 |
| 13. | Spot welder | 1 | 25,000 |
| 14. | TIG welding set | 1 | 1,00,000 |
| 15. | MIG welding set | 1 | 1,00,000 |
| 16. | Welding Partition Screen | 5 | 2,500 |
| **MATERIAL AND METALLURGY LABORATORY** | | | |
| 1. | Salt bath oil fired furnace | 1 | 30,000 |
| 2. | Salt bath electric resistance furnace | 1 | 40,000 |
| 3. | Electric furnace muffle type | 1 | 60,000 |
| 4. | Forced circulation tempering furnace | 1 | 30,000 |
| 5. | Quenching tank | 2 | 5,000 |
| 6. | Work benches | 2 | 4,000 |
| 7. | Pyrometers | 1 | 1,000 |
| 8 | Pot for bailing out the salt | 1 | 1,500 |
| 9. | Metallurgical microscope | 1 | 35,000 |
| 10. | Abrasive cut off machine | 1 | 50,000 |
| **APPLIED MECHANICS LABORATORY** | | | |
| 1. | Polygon of forces apparatus | 1 | 1,000 |
| 2. | Apparatus for reaction at supports | 1 | 1,000 |
| 3. | Jib crane | 1 | 1,000 |
| 4. | Screw jack | 1 | 300 |
| 5. | Inclined plane and friction apparatus | 1 | 500 |
| 6. | Worm and worm wheel | 1 | 1,500 |
| **STRENGTH OF MATERIALS LABORATORY** | | | |
| 1. | Brinell and Rockwell hardness tester | 1 | 30,000 |
| 2. | Impact testing machine | 1 | 20,000 |
| 3. | Microprocessor based universal testing machine | 1 | 4,00,000 |
| 4. | Torsion testing machine (fully computerized) | 1 | 2,00,000 |
| **ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY** | | | |
| 1. | Wattmeter | 5 | 10,000 |
| 2. | Ammeter | 5 | 10,000 |
| 3. | Voltmeter | 5 | 7,500 |

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| 4. | DC shunt motor | 1 | 5,000 |
| 5. | Single phase variac | 1 | 2,500 |
| 6. | Single phase transformer | 1 | 5,000 |
| 7. | Resistive load | 1 | 4,000 |
| 8. | Multimeter | 1 | 4,000 |
| 9. | CRO | 1 | 15,000 |
| 10. | Regulated supply | 1 | 8,000 |
| 11. | Signal generator | 1 | 5,000 |
| 12. | 3-phase inductor motor | 1 | 5,000 |
| 13. | 3-phase variac | 1 | 8,000 |
| 14. | DC shunt generator coupled with motor and starter | 1 | 25,000 |
| 15. | Rheostat | 2 | 2,500 |
| 16. | Tachometer | 1 | 5,000 |
| **MECHANICAL WORKSHOP** | | | |
| 1. | Centre lathes | 10 | 5,00,000 |
| 2. | Tool room lathe | 1 | 1,00,000 |
| 3. | Lathe with copy turning attachment and other attachments | 1 | 1,50,000 |
| 4. | Universal milling machine | 1 | 1,25,000 |
| 5. | Vertical milling machine | 1 | 75,000 |
| 6. | Shapers | 2 | 1,00,000 |
| 7. | Radial drilling machine | 1 | 25,000 |
| 8. | Upright drilling machine | 1 | 20,000 |
| 9. | Gear Shaper | 1 | 75,000 |
| 10. | Centreless grinder | 1 | 80,000 |
| 11. | Universal cylindrical grinder | 1 | 75,000 |
| 12. | Hydraulic surface grinder | 1 | 50,000 |
| 13. | Tool and Cutter grinder | 1 | 50,000 |
| 14. | Power hacksaw | 1 | 25,000 |
| 15. | Pedestal grinder | 1 | 5,000 |
| 16. | Electro discharge machine | 1 | 4,00,000 |

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| 17. | Work bench | 3 | 6,000 |
| 18. | Precision instruments | 1 | 5,000 |
| 19. | Surface plates | 2 | 15,000 |
| 20. | Hand tools and accessories | 2 | 6,000 |
| 21. | CNC trainer lathe | 1 | 3,00,000 |
| 22. | CNC trainer milling machine | 1 | 4,00,000 |
| 23. | PC Computer | 2 | 1,00,000 |
| 24. | Computer based NC Programming Software | 1 | 1,50,000 |
| 25. | CNC Simulation software | 1 | 1,00,000 |
| 26. | CNC Milling machine accessories and holding devices | LS | 1,00,000 |
| **HYDRAULICS LABORATORY** | | | |
| 1. | Piezometer tube | 2 | 1,000 |
| 2. | U tube differential manometer | 2 | 2,000 |
| 3. | Inclined manometer | 1 | 1,000 |
| 4. | Bourdan pressure gauge | 1 | 1,000 |
| 5. | Circuit Automobile Brake | 1 | 2,000 |
| 6. | Circuit of Hydraulic Ram | 1 | 5,000 |
| 7. | Bernoulli's apparatus | 1 | 15,000 |
| 8. | Venturimeter apparatus with differential manometer | 1 | 10,000 |
| 9. | Centrifugal pump | 1 | 25,000 |
| 10 | Model of pelton wheel | 1 | 5,000 |
| 11 | Model of Francis turbine | 1 | 5,000 |
| **THERMAL ENGINEERING LABORATORY** | | | |
| 1. | Throttling Calorimeter | 1 | 25,000 |
| 2. | Bomb Calorimeter | 1 | 40,000 |
| 3. | Junker's Gas Calorimeter | 1 | 30,000 |
| 4. | Gravimetric Analysis | 1 | 15,000 |
| 5. | Orsat Apparatus | 1 | 20,000 |
| 6. | Mechanical Types $Co_2$ Recorder | 1 | 25,000 |
| 7. | Single Stage Reciprocating | 1 | 50,000 |
| 8. | Rotary Compressor | 1 | 25,000 |

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| 9. | Flash Point Apparatus | 1 | 10,000 |
| 10. | Pyrometer | 2 | 2,000 |
| 11. | Lancashire boiler model | 1 | 5,000 |
| 12. | Model of impulse turbine | 1 | 5,000 |
| 13. | Model of reaction turbine | 1 | 5,000 |
| 14. | Model of surface condenser | 1 | 5,000 |
| 15. | Spring loaded safety valve | 1 | 6,000 |
| 16. | Single cylinder 2 stroke petrol engine | 1 | 35,000 |
| 17. | Single cylinder 4 stroke petrol engine | 1 | 40,000 |
| 18. | Multicylinder petrol engine test ring | 1 | 70,000 |
| **IQC LABORATORY** | | | |
| 1. | Digital vernier calliper | 3 | 5,000 |
| 2. | Digital micrometer | 3 | 5,000 |
| 3. | Height gauge | 2 | 1,500 |
| 4. | Depth gauge | 2 | 1,000 |
| 5. | Combination set | 1 | 1,000 |
| 6. | Bevel protractor | 1 | 1,000 |
| 7. | Sine bar | 1 | 1,000 |
| 8. | Precision balls and rollers | 1 | 500 |
| 9. | Surface plate | 2 | 15,000 |
| 10. | Slip gauges set | 1 | 10,000 |
| 11. | Comparator – Mechanical , Pneumatic | 2 | 40,000 |
| 12. | Gear tooth vernier | 1 | 2,000 |
| 13. | Snap and ring gauges | 1 | 1,500 |
| 14. | Feeler gauge, radius gauge | 1 | 1,000 |
| 15. | Angle plate | 1 | 1,000 |
| 16. | Tool makers microscope | 1 | 40,000 |
| 17. | Profile projector | 1 | 75,000 |
| 18. | Surface roughness tester | 1 | 60,000 |

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| **COMPUTER LABORATORY** | | | |
| 1. | IDEAS | 1 | 5,00,000 |
| 2. | AutoCAD | 1 | 50,000 |
| 3. | Computer – Pentium | 11 | 4,00,000 |
| 4. | Mechanical Desk Top | 1 | 50,000 |
| 5. | Catia | 1 | 2,00,000 |
| 6. | Digitiser | 1 | 50,000 |
| 7. | Plotter | 1 | 75,000 |
| 8. | Scanner | 1 | 3,500 |
| 9. | Printer (Laser, DMP) | 3 | 80,000 |
| **INSTALLATION, TESTING & MAINTENANCE** | | | |
| 1 | Compressor | 2 | 60,000 |
| 2 | Pumps | 1 | 40,000 |
| 3 | Drier | 1 | 20,000 |
| 4 | Pulley block | 1 | 5,000 |
| 5 | Mobile Crane | 1 | 30,000 |
| 6 | Fork Lift | 1 | 20,000 |
| 7 | Hydraulic Jack | 1 | 7,000 |
| 8 | Winch | 1 | 5,000 |
| **FABRICATION SHOP** | | | |
| 1 | Hammer | 10 | 10,000 |
| 2. | Anvil | 10 | 80,000 |
| 3 | Furnaces | 02 | 60,000 |
| 4 | Tongs | 10 | 7,000 |
| 5 | Copper bar | LS | 5,000 |
| 6 | Wire Drawing Die Set | 1 | 5,000 |
| 7 | Drawing machine | 1 | 15,000 |
| 8 | Cutter/ | 1 | 10,000 |
| 9 | Measuring tools | LS | 10,000 |
| 10 | Wooden Hammer | 10 | 5,000 |
| 11 | Sheet Metal | LS | 5,000 |

NOTE:

In addition to above, laboratories in respect of physics, chemistry will be required for effective implementation of the course.

Provision for overhead projector, TV with VCR facility slide cum strip projector, TV with VCR facility slide cum strip projector, 16 mm film projector, photocopier, PC-XT facilities, duplicating machines, drafting machines etc has also to be made.

### 9.1.2 Space Requirement:

Norms and standards laid down by All India Council for Technical Education (AICTE) may be followed to work out space requirement in respect of class rooms, tutorial rooms, drawing halls, laboratories, space required for faculty, student amenities and residential area for staff and students.

### 9.1.3 Furniture Requirement

Norms and standards laid down by AICTE be followed for working out furniture requirement for this course.

## 9.2 Human Resources:

Weekly work schedule, annual work schedule, student teacher ratio for various group and class size, staffing pattern, work load norms, qualifications, experience and job description of teaching staff workshop staff and other administrative and supporting staff be worked out as per norms and standards laid down by the AICTE

Following are the qualifications and experience for the teaching faculty and technical staff

| Qualification | Experience |
|---|---|
| **Lecturer**<br>First class B.E./B.Tech in Mechanical Engineering/Production Engineering/Fabricatkion Technology or equivalent | NIL |
| **Sr.Lecturer**<br>First class B.E./B.Tech in Mechanical Engineering/Production Engineering/Fabrication Technology or equivalent | 5 years experience in teaching/industry/ research at the level of Lecturer or equivalent |
| **Head of Department**<br>M.E./M.Tech in Mechanical Engineering/ Production Engineering/Fabrication Technology or equivalent with first class at Bachelor's level | 8 years experience in teaching/industry/ research at the level of Lecturer or equivalent |
| **Note:**<br>Candidates from industry/profession with B.E/B.Tech in Mechanical Engineering/Production Engineering/Fabrication Technology or equivalent and with recognized professional work experience equivalent to Master's degree and 5 years experience may also be eligible for the post of H.O.D. | 2 years industrial experience |
| **Workshop Superintendent**<br>First class B.E./B.Tech in Mechanical Engineering/Production Engineering/ Fabrication Technology or equivalent | 8 years industrial experience |
| OR<br>Diploma in Mechanical Engineering/Production Engineering/Fabrication Technology or equivalent | 2 years practical experiences in teaching/ industry at appropriate level |
| **Instructor/Technician**<br>Diploma in Mechanical Engineering/Production Engineering/Fabrication Technology or equivalent | |

## 10. RECOMMENDATIONS FOR EFFECTIVE IMPLEMENTATION OF CURRICULUM

The following recommendations are made for effective implementation of this curriculum.

a) While imparting instructions, stress should be laid on the development of practical skills in the students. For this purpose, as far as possible, classes should be conducted in the laboratories itself.

b) Industrial visits should be organized as and when required to clarify the concepts, principles and practices involved. For this purpose, time has already been provided in student centered activities

c) Extension lectures from professionals should be organized to impart instructions in specialized areas

d) There is no need of purchasing very costly equipment. Efforts may be made to establish linkages with local industrial organizations

e) Considerable stress should be laid on repair and maintenance of equipment

f) Teachers should generate competitiveness among the students for the development of professional skills.

g) Teachers should take working drawings from the industries and provide practices in reading these drawings

h) Hobby clubs and other co-curricular activities be promoted to develop creativity in the students

i) Teachers should be sent for training in the new areas incorporated in their curriculum

j) Students should be given well thought out project assignments. This can help students in developing creativity and confidence in them for gainful employment (wage and self)

A **project bank** should be developed by the concerned Department in consultation with local industry.