CURRICULUM

FOR THE TRADE OF

PATTERN MAKER

UNDER

APPRENTICESHIP TRAINING SCHEME

2017

सत्यमेव जयते
Government of India

GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENURESHIP
DIRECTORATE GENERAL OF TRAINING

CONTENTS

1. ACKNOWLEDGEMENT

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1. Mahindra CIE Automotive Ltd., Pune

Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

Co-ordinator for the course: Sh. Nirmalya Nath., ADT

Sl. No.	Name & Designation Sh./Mr./Ms.	Organization	Expert Group Designation
1.	Ravindra More,	Mahindra CIE Automotive Ltd., Pune	Expert
2.	Jugal Kishore Biswas, Instructor	ITI Medinipur, West Bengal	Expert

2. BACKGROUND

2. 1. Apprenticeship Training Scheme under Apprentice Act 1961

The Apprentices Act, 1961 was enacted with the objective of regulating the programme of training of apprentices in the industry by utilizing the facilities available therein for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart Apprenticeship Training on the job in industry to school leavers and person having National Trade Certificate(ITI pass-outs) issued by National Council for Vocational Training (NCVT) to develop skilled manpower for the industry**.** There are four categories of apprentices namely**; trade apprentice, graduate, technician and technician (vocational) apprentices.**

Qualifications and period of apprenticeship training of **trade apprentices** vary from trade to trade. The apprenticeship training for trade apprentices consists of basic training followed by practical training. At the end of the training, the apprentices are required to appear in a trade test conducted by NCVT and those successful in the trade tests are awarded the National Apprenticeship Certificate.

The period of apprenticeship training for graduate (engineers), technician (diploma holders and technician (vocational) apprentices is one year. Certificates are awarded on completion of training by the Department of Education, Ministry of Human Resource Development.

2. 2. Changes in Industrial Scenario

Recently we have seen huge changes in the Indian industry. The Indian Industry registered an impressive growth during the last decade and half. The number of industries in India have increased manifold in the last fifteen years especially in services and manufacturing sectors. It has been realized that India would become a prosperous and a modern state by raising skill levels, including by engaging a larger proportion of apprentices, will be critical to success; as will stronger collaboration between industry and the trainees to ensure the supply of skilled workforce and drive development through employment. Various initiatives to build up an adequate infrastructure for rapid industrialization and improve the industrial scenario in India have been taken.

2. 3. Reformation

The Apprentices Act, 1961 has been amended and brought into effect from 22nd December, 2014 to make it more responsive to industry and youth. Key amendments are as given below:

- Prescription of number of apprentices to be engaged at establishment level instead of trade-wise.

- Establishment can also engage apprentices in optional trades which are not designated, with the discretion of entry level qualification and syllabus.

- Scope has been extended also to non-engineering occupations.

- Establishments have been permitted to outsource basic training in an institute of their choice.

- The burden of compliance on industry has been reduced significantly.

3. RATIONALE

(Need for Apprenticeship in **Pattern Maker** trade)

1. Able to produce full size, three-dimensional models,
2. They can make the models with a range of materials, such as wood, metal, plastic and wax.
3. planning the best way to make patterns from 2D and 3D drawings
4. creating a prototype pattern using hand tools and computer-controlled machinery
5. making a sample casting, using the prototype to check it meets customer requirements
6. changing the pattern to remove any defects
7. Producing a finished pattern ready for the foundry molders to make castings.
8. Able to work out and set tolerance levels to take account of molten metal shrinking as it cools during the casting process.

4. JOB ROLES: REFERENCE NCO

Brief description of Job roles:

Pattern Maker, Wood makes and repairs wooden patterns from drawings or samples for making moulds to cast metals using hand or power tools or both. Studies drawings or sample, calculates sizes and quantity of timber required. Selects right type of timber for making pattern. Saws, adzes and planes oversize pieces to required size and marks them with shrinkage allowance, using construction scale calipers, divider, pencil, scribber etc. Drills holes and fixes dowels for assembling detachable parts and screws or nails other pieces permanently as necessary. Builds up undersized portions by nailing or screwing card board, plywood, thin pieces of wood or by applying putty as required. Assembles completed pattern, checks measurements and rectifies defects if any. Fills superfluous holes with molten sealing wax or with any other filling, Smoothens surface by filling or with sand paper for better finish. Sharpens his own tools. May apply preservative coating of solution of shallac and spirit or any other water proof paint.

Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

Perform TPM (Total Production Management), TQM (Total Quality Management) and record keeping system.

Reference NCO:

i) **NCO-2015: --** 7522.1000

5. GENERAL INFORMATION

1. **Name of the Trade** **: PATTERN MAKER**

2. **N.C.O. Code No.** **: NCO-2015:** --7522.1000

3. **Duration of Apprenticeship Training (Basic Training + Practical Training):**15 Months

4. **Duration of Basic Training**: -

a) Block –I : 3 months

Total duration of Basic Training: 3 months

5. **Duration of Practical Training (On -job Training): -**

a) Block–I: 12 months

Total duration of Practical Training: 12 months

6. **Entry Qualification** : Passed 8th class examination from a recognised school.

7. **Selection of Apprentices:** The apprentices will be selected as per Apprentices Act amended time to time.

8. **Rebate for ITI passed trainees** : i) **Three months** in the trade of **Carpenter.**

Note: Industry may impart training as per above time schedule for different block, however this is not fixed. The industry may adjust the duration of training considering the fact that all the components under the syllabus must be covered. However the flexibility should be given keeping in view that no safety aspects is compromised.

6. COURSE STRUCTURE

Training duration details: -

Time (in months)	1-3	4-15
Basic Training	Block– I	-----
Practical Training (On - job training)	----	Block – I

Components of Training ⬇	Duration of Training in Months ➡														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Basic Training Block - I															
Practical Training Block - I															

7. SYLLABUS

7.1 BASIC TRAINING
(BLOCK – I)
DURATION: 03 MONTHS

GENERAL INFORMATION

1) **Name of the Trade** : **PATTERN MAKER**
2) **Hours of Instruction** : 500 Hrs.
3) **Batch size** : 20
4) **Power Norms** : 8 KW for Workshop
5) **Space Norms** : 120 Sq. m.
6) **Examination** : The internal assessment will be held on completion of each Block.
7) **Instructor Qualification** :

i) Degree/Diploma in Mechanical/Metallurgy Engineering/Advanced Diploma in Foundry Technology from recognized university/Board with one/two year post qualification experience respectively in the relevant field.

OR

ii) NTC/NAC in the trade of **Pattern Maker** with three year post qualification experience in the relevant field.

Preference will be given to a candidate with Craft Instructor Certificate (CIC)

8) **Tools, Equipments & Machinery required**: - As per Annexure – I

7.1.1 DETAIL SYLLABUS OF CORE SKILL

A. Block– I
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation	Duration (in hours)
1.	Engineering Drawing: Introduction and its importance Different types of standards used in engineering drawing. Drawing Instruments: their uses Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips.	**30**	**Units & Measurements-** FPS, CGS, MKS/SI unit, unit of length, Mass and time. Fundamentals and derived units Conversion of units and applied problems.	**20**
2.	Lines : types and applications in Drawing as per BIS SP:46-2003 Drawing geometrical object using all types of lines. **Drawing of Geometrical Figures:** Angle, Triangle, Square, Rectangle and Circle. **Letters: -** Lettering styles, Single stroke letters and numbers as per IS standard. Lettering practice		**Material Science** : properties - Physical & Mechanical, Types - Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals	
3.	**Dimensioning-** Types of dimension, elements of dimensions, Methods of indicating Values, Arrangement, Alignment and indication of dimensions. **Scales**:-Types use and construction. Representative factor of scale.		**Mass .Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density,	
4.	Method of presentation of Engineering Drawing - Pictorial View - Orthogonal View - Isometric view		**Speed and Velocity:** Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation. Average Velocity, Acceleration & Retardation. Related problems. Circular Motion: Relation between circular motion and Linear motion, Centrifugal	

			force, Centripetal force	
5.	**Constructions: -** Draw proportionate free hand sketches of plane figures. Sketch horizontal, vertical and inclined line by free hand, Draw circles by free hand using square and radial line method, Draw arcs and ellipse by free hand		**Ratio & Proportion** : Simple calculation on related problems. **Percentage:** Introduction, Simple calculation.	
6.	Projections: Concept of axes plane and quadrant. Orthographic projections Method of first angle and third angle projections (definition and difference) Symbol of 1^{st} angle and 3^{rd} angle projection as per IS specification. Free hand Drawing of Orthographic projection from isometric/3D view of geometrical blocks		**Work, Power and Energy:** work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy. Meaning of H.P., I.H.P., B.H.P., and F.H.P. and CC and Torque.	
7.	**Screw :-** Its Types and Sizes, Screw thread, their standard forms as per BIS, external and internal thread.	**30**	**Algebra:** Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	**20**
8.	**Rivets and Joints:-** Prepare a drawing sheet on rivets nomenclature and Joints.		**Heat & Temperature:** Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.	
9.	Free hand Sketches for simple pipe line with general fittings.		**Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids - cube, cuboid, cylinder and Sphere. Surface area of solids -cube, cuboid, cylinder and Sphere. Volume of cut-out solids: hollow cylinders, frustum of cone, block section. Volume of simple solid blocks.	

10.	Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries.		**Basic Electricity:** Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections - series, parallel, electric power, Horse power, energy, unit of electrical energy. Concept of earthling.	
11.	Simple exercises related to trade related symbols. Basic electrical and electronic symbols		**Simple machines** **Transmission of power: -** Transmission of power by belt, pulleys & gear drive. **Heat treatment process: -** Heat treatment and advantages. Annealing, Normalizing, Hardening, Tempering.	
12.	Free hand sketch of trade related components / parts /cutting tool indicating angles.		**Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables. Finding the value of unknown sides and angles of a triangle by Trigonometrical method. Finding height and distance by trigonometry. Application of trigonometry in shop problems. (viz. taper angle calculation). Calculate the area of triangle by using trigonometry and application of Pythagoras theorem.	
13.			**Concept of pressure** - **Definition**:-Force, Pressure, and their units, atmospheric pressure, gauges used for measuring pressure, problems. Introduction to pneumatics & hydraulics systems.	
14.	**Simple exercises related to trade related Test Papers. Solution of NCVT test papers.**			

7.1.2 DETAIL SYLLABUS OF PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

A. Block –I
Basic Training

Week No.	Professional Skills	Professional Knowledge
1)	Safety: - its importance, classification, personal, general, workshop and job safety. Occupational health and safety. Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Preventive measures for electrical accidents & steps to be taken in such accidents. Importance of housekeeping & good shop floor practices. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Fire& safety: Use of Fire extinguishers.	Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Institute system including stores procedures. Introduction of First aid. Safety attitude development of the trainee by educating him to use Personal Protective Equipment (PPE). Response to emergencies eg; power failure, fire, and system failure. Accidents- Definition types and causes. First-Aid, nature and causes of injury and utilization of first-aid. Introduction to 5S concept & its application. Fire: - Types, causes and prevention methods. Fire Extinguisher, its types. Global warming its causes and remedies. Industrial Waste its types, sources and waste Management.
2)	Metal work (Fitting). Use of steel rules, scribers, dividers, engineers' squares, calipers, chisels, hacksaws, files, punches and hand drilling machine etc. Simple operations such as chipping, sawing, filling, drilling, marking out from blue prints and simple fitting of two parts. Reading of standard and contraction rules, simple operations such as hand sawing, hand planing, marking, chiseling, gauging & sharpening of tools.	Importance of safety & general precautions observed in the section. Importance of the trade in the development of industrial economy of the country. Safety precautions. Description and uses of fitters' hand tools. Description of various measuring instruments. Types of files. Classification of files. Filing procedure. Description, uses and manipulation of measuring tools, common saws, planes, try square and gauges.

3)	Making of various joints such as cross half lap joints, 'T' lap joints, dovetail halving corner bridle joint, mortice and tenon joint. Wood turning in lathe to make various shapes; turning tools sharpening and grinding. Making simple jobs on wood turning lathe.	Description, types, uses and manipulation of chisels, drill and braces; types of drills, files & calipers; care & maintenance of above tools Description, types and uses of vices, screw drivers, shapening stones, work bench, turning tools (wood), miscellaneous tools such as glue pot, glue brush, painting brush, spirt level and plumb bob etc. Uses of raw materials and joining materials; machine tools-their parts, uses and maintenance-safety precautions.
4)	**Moulding :** Machinery used in the trade, types of jobs made by the trainees in the trade, introduction to safety including firefighting equipment and their uses etc. Sand mixing, sifting & tempering by shoval, sieve etc. Preparation of facing sand and backing sand. Preparation of simple mould in the pit using facing and backing sand.	Importance of moulding trade training; Types of foundries-advantages of moulding and casting process. Use of bottom board or mould board. Various terms & materials used in moulding process such as ramming, venting, silica sand, clay etc. -their meaning and explanation. Moulding, tools; sieves, trowels, rammers, cleaners, shovels and strike off bar etc. -their care, maintenance & use.
5)	Practice in preparing a bend pipe core. Practice in reinforcement & driving the core. Dressing of the core. Practice in making the cores such as vertical core, Horizontal core & balancing core Trade Training (Pattern Making) : Making layouts of simple patterns showing draft, machining and other allowances.	Core and its purpose, Terms and materials used in core making, safety precautions to be observed while making a core. Use of rapping and lifting plates. Amount of shirnkage allowances for small casting and large casting in different types of metals. Allowances for draft, drag and cope; shake allowance & machining allowance. Types of core boxes such as half core box, whole core box, dump core box, framed core box, core box for vertical core, core box for horizontal core & cover core on hanging core. Use of symbols for machining and finishing the surface of the job. Use of sand-paper for finishing the job. Technique and procedure for making simple patterns and description of tools used.
6)	Making simple patterns such as patterns having draft and contraction allowances & Pattern of round block (one piece pattern). Making simple hollow pattern with outside & inside draft. Blue-Matching techniques & method for mating parts & patterns.	Terms relating to pattern making. Use of draft, shrinkage, finish, machine etc. Principles of making the mould from a hollow pattern. Types of layout board. Advantages & disadvantages of different types of boards. Selection of suitable timber for the job. Kinds of timber used in pattern making. Cross - section of a log. Deciding parting line for a built-up pattern.
7)	Making a simple pattern having a cored hole (by solid construction).	Wood technology-tree growth, classification of timber and Falling of timber. Dowel and Dowel pins-their shapes and use.

		Defects in timber; types of knots such as branches knot, dead knot, splay or spike knot and round knot. Alternative method of making a solid pattern and split pattern. Use of dowels and its correct procedure of fixing.
8)	Making pattern by buildup construction. Making pattern & core boxes for various types of valves. Pattern and core boxes for bend pipe- 'U' shaped pipe.	Types of glues & uses. Preparation of animal glue. Application of glue. Different types of cores & core boxes-their use and construction technique. Contraction allowances Reading of simple blue in pattern for bronze. prints. Effect of seasoning and properties of timber. Selection of timber for the specific job depending upon size, shape & number of casting required. Finishing pattern as per I. S. I. specifications and colour code. Types of screws & their gauge numbers. Screwing methods; use of different types of screw drivers. Drills; selection of drills according to the screw sizes. Different types of core-boxes - their construction and uses. Various methods of making pattern for their construction, core prints and core boxes.
9)	Preparation of pattern of C. I. faces chuck with slots. Pattern of simple hand wheel by the help of lathe. Pattern for C. S. drive sprocket consisting of Segment-Const ruction, Wood turning & taper turning, Core box.	Principles of joints & their uses in pattern making. Different types of face chucks- patterns and their casting. Layout of C.I. bearing stand; Circular saw - its parts, functions, working, adjustment of saw blade, lubrication and maintenance. Layout of hand wheel; use of templates; repair and setting of band saw blade. Description of wood turning lathes-its various parts and their functions & setting of job. Various operations on this machine. Surface planer-its parts and adjustments for carrying out different operations.

10)	Use of plaster of parts in making uneven patterns. Pattern with drop and tail core prints.	Plaster of paris-brief description, properties and uses. Types of fillets-leather fillet, use of ply-wood, Grinding machine – parts and functions – grinding, Dressing of grinding wheel & safety precautions. Disk sander machine-its parts and functions, safety precautions of sanding machine; Care and maintenance of the machine. Description of pattern for tail and Drop prints. Different parts of a pulley. Lay out of six arm pulley. Making of templates for segments; cutting of segments. Use of turning machine. Turning & finishing the pattern of pulley.
11)	Skeleton pattern of C. I. Bend pipe; making a core box with the help of strickle. Preparation of master pattern Pattern of gear by two methods (a) Core boxes only (b) Pattern only.	Lay out of skeleton bend pipe. Advantages and disadvantages of a skeleton pattern over a solid or split pattern. Method of making core box with strickle. Layout of fly wheel, (making a part pattern instead of whole pat -tern); sweep pattern-its use, parts and advantages, Process of sweep mouling. Layout of master pattern of brass bearing. Principles of master pattern; advantages and uses of master pattern-mass production work-Under taking for double machining contraction allowances. Knowledge of Araldite or plastic pattern. Araldits-Description, Properties & uses. Layout of match plate pattern and description of match plates. Layout of spur-gear, Teeth Calculation. Layout of bevel gear; formula of teeth; common types of gears, construction of gear wheels. Using a jig to form teeth. Method of making chain pulley pattern-Know ledge of chains & pulley.
12)	Inspection of pattern and Core boxes. Repairs & maintenance of old patterns.	Inspection-its methods and purpose. Maintenance procedure Estimation of materials. Use of hand book & reference tables.
13)	**Revision & Internal Assessment**	

7.1.3 EMPLOYABILITY SKILLS

GENERAL INFORMATION

1) **Name of the subject** : **EMPLOYABILITY SKILLS**

2) **Applicability** : ATS- Mandatory for fresher only

3) **Hours of Instruction** : **110 Hrs. (55 hrs. in each block)**

4) **Examination** : The examination will be held at the end of two years Training by NCVT.

5) **Instructor Qualification** :

i) MBA/BBA with two years experience or graduate in sociology/social welfare/Economics with two years experience and trained in Employability skill from DGET Institute.

And

Must have studied in English/Communication Skill and Basic Computer at 12th /diploma level

OR

ii) Existing Social Study Instructor duly trained in Employability Skill from DGET Institute.

7.1.3.1 SYLLABUS OF EMPLOYABILITY SKILLS

A. Block – I
Basic Training

Topic No.	Topic	Duration (in hours)
	English Literacy	**15**
1	**Pronunciation :** Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)	
2	**Functional Grammar** Transformation of sentences, Voice change, Change of tense, Spellings.	
3	**Reading** Reading and understanding simple sentences about self, work and environment	
4	**Writing** Construction of simple sentences Writing simple English	
5	**Speaking / Spoken English** Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.	
	I.T. Literacy	**15**
1	**Basics of Computer** Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.	
2	**Computer Operating System** Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.	
3	**Word processing and Worksheet** Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets	
4.	**Computer Networking and INTERNET** Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page	

	and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.	
	Communication Skill	**25**
1	**Introduction to Communication Skills** Communication and its importance Principles of Effective communication Types of communication - verbal, non verbal, written, email, talking on phone. Non verbal communication -characteristics, components-Para-language Body - language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort. Case study/Exercise	
2	**Listening Skills** Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active Listening Skills.	
3	**Motivational Training** Characteristics Essential to Achieving Success The Power of Positive Attitude Self awareness Importance of Commitment Ethics and Values Ways to Motivate Oneself Personal Goal setting and Employability Planning. Case study/Exercise	
4	**Facing Interviews** Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview	
5	**Behavioral Skills** **Organizational Behavior** Problem Solving Confidence Building Attitude Decision making Case study/Exercise	
	Entrepreneurship skill	**15**
1	**Concept of Entrepreneurship** **Entrepreneurship**- Entrepreneurship - Enterprises:-Conceptual issue Entrepreneurship vs. Management, Entrepreneurial motivation. Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.	

2	**Project Preparation & Marketing analysis** Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of Product Life Cycle (PLC), Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.	
3	**Institutions Support** Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.	
4	**Investment Procurement** Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.	
	Productivity	**10**
1	**Productivity** Definition, Necessity, Meaning of GDP.	
2	**Affecting Factors** Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.	
3	**Comparison with developed countries** Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.	
4	**Personal Finance Management** Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.	
	Occupational Safety, Health & Environment Education	**15**
1	**Safety & Health** Introduction to Occupational Safety and Health importance of safety and health at workplace.	
2	**Occupational Hazards** Basic Hazards, Chemical Hazards, Vibro-acoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.	
3	**Accident & safety** Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.	
4	**First Aid** Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person	
5	**Basic Provisions** Idea of basic provision of safety, health, welfare under legislation of India.	
6	**Ecosystem** Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.	
7	**Pollution** Pollution and pollutants including liquid, gaseous, solid and hazardous waste.	
8	**Energy Conservation** Conservation of Energy, re-use and recycle.	

9	**Global warming** Global warming, climate change and Ozone layer depletion.	
10	**Ground Water** Hydrological cycle, ground and surface water, Conservation and Harvesting of water	
11	**Environment** Right attitude towards environment, Maintenance of in -house environment	
	Labour Welfare Legislation	**5**
1	**Welfare Acts** Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.	
	Quality Tools	**10**
1	**Quality Consciousness :** Meaning of quality, Quality Characteristic	
2	**Quality Circles :** Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles.	
3	**Quality Management System :** Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.	
4	**House Keeping :** Purpose of Housekeeping, Practice of good Housekeeping.	
5	**Quality Tools** Basic quality tools with a few examples	

7.2 PRACTICAL TRAINING (ON-JOB TRAINING)
(BLOCK – I)
DURATION: 12 MONTHS

GENERAL INFORMATION

1) **Name of the Trade** : **PATTERN MAKER**
2) **Batch size** : 20
3) **Examination** : i) The internal assessment will be held on completion of each block
   ii) NCVT exam will be conducted at the end of 2nd year.
4) **Instructor Qualification** :

i) Degree/Diploma in Mechanical/Metallurgy Engineering/Advanced Diploma in Foundry Technology from recognized university/Board with one/two year post qualification experience respectively in the relevant field.

OR

i) NTC/NAC in the trade of **Pattern Maker** with three year post qualification experience in the relevant field.

Preference will be given to a candidate with Craft Instructor Certificate (CIC)

5) **Infrastructure for On-Job Training** : - As per Annexure – II

BROAD SKILL COMPONENT TO BE COVERED DURING ON- JOB TRAINING

A. BLOCK – I
DURATION: 12 MONTHS

1. Safety and best practices/Basic Industrial Culture (5S, KAIZEN, etc.)
2. Prepare different types of documentation as per industrial need by different methods of recording information.
3. Preparing patterns of circular from involving turning formation or construction of arms (add and even numbers) building up rims in segmental construction such as hand wheels flanged rims in pulleys rope pulleys.
4. Preparing section or segment core boxes for wheels pulleys for preparing moulds by core assembly.
5. Making patterns with cover core print such as patterns for piston, elbow with side outlet and their core boxes.
6. Preparing split patterns with non-identical cope and drag parts involving working out curved forms from solid stock such as patterns for lathe tail stock, shackle, pipe vice, bench vice and their core boxes.
7. Finishing and painting of patterns as per ISI colour scheme.
8. Making pattern in 'Shell' form involving turning internal, external shapes on curving out by hand tools such as patterns for cylinder head, electric motor side shell C.I. switch box cover.
9. Preparing "Follow board for Shell" form pattern using plaster of paris.
10. Preparing pattern for air chamber and its core model involving turning.
11. Preparing core box for air chamber pattern by joining series of strip (b) using plaster of paris.
12. Making patterns involving web and rib, construction of thin section such as pattern for J hanger bracket.
13. Preparing patterns and core boxes for various types of valve.
14. Preparing pattern for pipes and their core boxes involving building of stock in stepped form and finishing them such as water jacked pipe and its core boxes.
15. Preparing patterns for pipes and elbows and their core boxes involving staved construction.
16. Making pattern for gear wheels, sprocket wheels involving turning and formation of teeth.
17. Preparing segment or part core boxes for gear wheel patterns for making moulds by core assembly.
18. Preparing "Master Patterns" for casting metal patterns and core boxes. *
19. Finished cast metal patterns and core boxes by hand tools and machine tools. *
20. Preparing moulds using plaster of paris epoxy resins.*

21. Preparing patterns and core boxes using epoxy resins.*
22. Making skeleton patterns and core boxes with strickles.
23. Preparing and mounting various types of patters on match plates (Wooden and metal) including gating systems.
24. Making patterns for chills for producing chilled castings.
25. Preparing patterns for core dryers of various forms.
26. Making of different types of production patterns.*
27. Use of production patterns for machine mould.*
28. Performing various operations on wood working machines used for pattern making.*
29. Inspection of patterns and core boxes.*
30. Inspection of casting/ Dimensional layout of casting. *
31. Repair and maintenance of the patterns and core boxes.*
32. Machine shop observation of various machining operations.*
33. Perform TPM (Total Production Management), TQM (Total Quality Management) and record keeping system.

NOTE:

The operation skills marked (*) are mandatory.

8. ASSESSMENT STANDARD

8.1 Assessment Guideline:

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration to be given while assessing for team work, avoidance/reduction of scrape/wastage and disposal of scarp/wastage as per procedure, behavioral attitude and regularity in training.

The following marking pattern to be adopted while assessing:

a) Weightage in the range of 60-75% to be allotted during assessment under following performance level:

For this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- many tolerances while undertaking different work are in line with those demanded by the component/job.
- a fairly good level of neatness and consistency in the finish
- occasional support in completing the project/job.

b) Weightage in the range of above75%- 90% to be allotted during assessment under following performance level:

For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- the majority of tolerances while undertaking different work are in line with those demanded by the component/job.
- a good level of neatness and consistency in the finish
- little support in completing the project/job

c) Weightage in the range of above 90% to be allotted during assessment under following performance level:

For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.

In this work there is evidence of:

- high skill levels in the use of hand tools, machine tools and workshop equipment
- tolerances while undertaking different work being substantially in line with those demanded by the component/job.
- a high level of neatness and consistency in the finish.
- minimal or no support in completing the project

8.2 FINAL ASSESSMENT- ALL INDIA TRADE TEST FOR APPRENTICE

SUBJECTS	Marks	Sessional Marks	Full Marks	Pass Marks	Duration of Exam.
Practical	300	100	400	240	08 hrs.
Trade Theory	100	20	120	48	3 hrs.
Workshop Cal. & Sc.	50	10	60	24	3 hrs.
Engineering Drawing	50	20	70	28	4 hrs.
Employability Skill	50	-	50	17	2 hrs.
Grand Total	**550**	**150**	**700**	**-**	

Note: - The candidate pass in each subject conducted under all India trade test.

9. FURTHER LEARNING PATHWAYS

Employment opportunities:

On successful completion of this course, the candidates may be gainfully employed in the following industries:

1. Production & Manufacturing industries involved in Pattern making and Foundry related work.

ANNEXURE – I

TOOLS & EQUIPMENT FOR BASIC TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TRADE: PATTERN MAKER

LIST OF TOOLS & EQUIPMENTS FOR 20 APPRENTICES

A : TRAINEES TOOL KIT:-

Sl. No.	Description	Qty.
1.	Square try 20 cms.	20
2.	Scriber	20
3.	glinding T-bevel	20
4.	Marking gauge	20
5.	Wing Compass	20
6.	Hand saw 20 cms	20
7.	Tenon saw 30 cms	20
8.	Jack plane (Iron)	20
9.	Smoothing plane (Iron)	20
10.	Mallet with handle	20
11.	Chisel firmer 6 mm. , 12mm. and 25 mm.	20 each
12.	Chisel Mortise 9 mm.	20
13.	Chisel Bradawl	20
14.	Rule contraction in inches & mm	20
15.	Square try 15 cms	20
16.	Caliper outside 15 cms, spring	20
17.	Caliper inside 15 cms, spring	20

18.	Dividers - 15 cms, spring	20
19.	Punch Centre 10 cms	20
20.	Screw driver 25 cms and 15 cms	20 each
21.	Chisel cold flat 1 **9** mm.	20
22.	File flat rough 25 cms	20
23.	File half round 2nd cut 2 5 cms	20
24.	Rasp 30 cms	20
25.	Hammer ball pein 0. 5 Kg.	20
26.	Hammer 224 grams warington pattern	20
27.	Iron rabbet plane	20

B: Tools, Instruments and General Shop Out fits

Sl. No.	Description	Quantity
28.	Carpenter's Clario hammer	8
29.	Spirit level 30 cms	4
30.	Glue 2.5 Kg. or 1 Kg.	2
31.	Trying plane	4
32.	Rabbet plane	4
33.	Grooving plane 12 mm, 6 mm.	4 each
34.	Plough plane	4
35.	Firmer Gauge 6 mm., 9 mm., 12 mm. & 19 mm.	4 sets
36.	Brace bits, 12 mm. to 3.75 cms., centre	4 sets
37.	Brace bits 6 mm. to 19 mm by 0. 75 mm. auger bits	2 sets
38.	Auger hand 19 mm., 21 mm.. & 25 mm.	2 sets
39.	Trammel	2 pairs
40.	Spoke shave 44 mm. cutter, round and flat face (Metal)	4 each
41.	Odd leg calipers	4
42.	Oil Stone 20 cms x 5 cms x 2. 5 cms coarse and smooth	8 each
43.	Saw, set, Pistol grip type	2
44.	Mortise gauge	4
45.	Oil can	2

46.	Bench working 245 x 120 x 60 cms	8
47.	Vice, carpenter 30 cms jaw	16
48.	Engineers[1] vice 12 cms Jaws	4
49.	Cramp, carpenter 7. 5 cms.	4
50.	Pincers 15 cms.	16
51.	Ratchet brace	8
52.	Hand drill 6 mm.	4
53.	Stone grinding with through motorised	1
54.	Almirah 180 x 90 x 45 cms.	1
55.	Drill twist 4 mm to 6 mm by 0. 75 mm.	2 sets
56.	Hacksaw frame, adjustable for 20 cms	2
57.	Rule 24" two fold brass tipped in inches and mm	16
58.	Trowel square and heart	4 each
59.	Hammer ball pein 1 Kg. with handle	4
60.	Smoother inside corner	4
61.	Smoother Top edge	4
62.	Smoother egg corner	4
63.	Cleaner	4
64.	Rammer (Pein and flat end)	4
65.	Vent wire	4
66.	Bellows, hand	4
67.	Shovel	4
68.	Shieve 1.5 mm. mesh 40 cms dia	4
69.	Brush, soft 25 mm.	4
70.	Brush, soft 5 cms.	4
71.	Wooden mallet 15 cms x 6. 25 cms for foundry work	4
72.	Bursh, wire, foundry 18.75 cms x 6. 25 cms.	2
73.	Blow lamp	2
74.	Caliper, outside 20 cms.	2
75.	Caliper, inside 20 cms.	2
76.	Chisel, cold, flat 2. 5 cms x 22. 5 cms	4
77.	File, flat 30 cms.	2
78.	Hammer, sledge, double faced 3.5 Kg.	2
79.	Engineer[1] s metal, sprit level	2
80.	Mirror 15 x 10 cms.	4
81.	Box moulding 30 cms square with accessories	4 pairs
82.	Torch, hand, electric	2
83.	Pit, Furnace	2
84.	Goggles	4 pairs

85.	Hand gloves	4 pairs
86.	Desk	1
87.	Table	1
88.	Stool	1
89.	Blackboard with easel	1
90.	Fire extinguisher	1
91.	Fire buckets	4
92.	G cramp 15 cms, Opem's	2
93.	G cramp 20 cms, Opem's	2
94.	Compass saw	4
95.	Key hole saws	2
96.	Block Plane	2
97.	Wood counter sunk bits 12 mm.	4
98.	Laddie, carrier	1
99.	Triangular file 17.5 cms slim taper	4
100.	Saw sharpening, vice	2
101.	Nail punch	4
102.	Bevelled edge chisels 2. 5 cm, 19 mm, .12 mm.	2 each
103.	Round file, bastard 25 cms.	4
104.	Turning tool (one set of 6 numbers)	2 sets
105.	Wing compass	8
106.	File brush	4
107.	Lockers with 8 drawers	1
108.	Crucible 10 Kg. cap with forge	1
109.	Painting tools and brushes	2 sets
110.	Dovetail saw 20 cms	6 nos

C : General Machinery Shop outfit

Sl. No.	Name & Description of Machine	Quantity
111.	Band saw 60 cms wheel size	1
112.	Circular saw 45 cms blade size	1
113.	Wood turning Lathe 120 cms size with screwed chuck and face plate	1
114.	Adjustable saw sharpening machine	1
115.	Disk and hole in sander machine	1
116.	Surface and thickness planing machine	1
117.	Bench grinder motorised D/E 17. 5 cms Wheel	1

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: PATTERN MAKER

LIST OF TOOLS & EQUIPMENTS FOR 20 APPRENTICES

1) **Space Norms** : 45 Sq. m.(For Engineering Drawing)

2) Infrastructure:

A : TRAINEES TOOL KIT:-

Sl. No.	Name of the items	Quantity (indicative)
1.	Draughtsman drawing instrument box	20 Nos.
2.	Set square celluloid 45^0 (250 X 1.5 mm)	20 Nos.
3.	Set square celluloid 30^0-60^0 (250 X 1.5 mm)	20 Nos.
4.	Mini drafter	20 Nos.
5.	Drawing board (700mm x500 mm) IS: 1444	20 Nos.

B : FURNITURE REQUIRED

Sl. No.	Name of the items	Quantity (indicative)
1	Drawing Board	20 Nos.
2	Models : Solid & cut section	as required
3	Drawing Table for trainees	as required
4	Stool for trainees	as required
5	Cupboard (big)	01
6	White Board (size: 8ft. x 4ft.)	01
7	Trainer's Table	01
8	Trainer's Chair	01

ANNEXURE – II

INFRASTRUCTURE FOR ON-JOB TRAINING

TRADE: PATTERN MAKER

For Batch of 20 APPRENTICES

Actual training will depend on the existing facilities available in the establishments. However, the industry should ensure that the broad skills defined against On-Job Training part (*i.e. 12 months*) are imparted. In case of any short fall the concern industry may impart the training in cluster mode/ any other industry/ at ITI.

ANNEXURE-III

GUIDELINES FOR INSTRUCTORS AND PAPER SETTERS

1. Due care to be taken for proper & inclusive delivery among the batch. Some of the following some method of delivery may be adopted:

A) LECTURE
B) LESSON
C) DEMONSTRATION
D) PRACTICE
E) GROUP DISCUSSION
F) DISCUSSION WITH PEER GROUP
G) PROJECT WORK
H) INDUSTRIAL VISIT

2. Maximum utilization of latest form of training viz., audio visual aids, integration of IT, etc. may be adopted.

3. The total hours to be devoted against each topic may be decided with due diligence to safety & with prioritizing transfer of required skills.