National Institute of Technical Teachers Training and Research
Institution Deemed to be University under Distinct Category, A Centrally Funded Technical Institute
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राष्ट्रीय तकनीकी शिक्षक प्रशिक्षण एवं अनुसंधान संस्थान
विशिष्ट श्रेणी के तहत मानित विश्वविद्यालय संस्थान, एक केंद्रीय वित्त पोषित तकनीकी संस्थान
शिक्षा मंत्रालय, भारत सरकार, तरमणि, चेन्नई – ६०० ११३, भारत.

Scheme of Examination

The selection process for the recruitment of Technical Officer (Workshop Superintendent) would comprise of two stages viz., (a) Written test (b) Trade Test and Interview

Stage	Type of Test	Time	Details
Stage -1	Multiple Choice Question exam (as per Annexure 1)	120 Minutes	100 Objective Questions – 100 Marks
Stage–2	Trade Test (as per Annexure 2)	120 Minutes	One of the trades of candidate choice
Stage–3	Interview	30 Minutes per candidate	Detailed presentation for 20 minutes of their experience and Q&A

(a) Written test (Stage 1):

The written test would be conducted for 120 minutes in the form of Multiple Choice and descriptive Questions and syllabus for the MCQ exam is provided in the Annexure 1. The top 10 candidates will be selected for stage 2.

(b) Trade Test (Stage 2)

The trade test in the required trade will be conducted in the forenoon for the top 10 candidates selected during stage 1. At this stage, applicants will be required to demonstrate their technical skills and competence in one of the trades listed in Annexure II. At the beginning of the trade Test, applicants will be taken on a tour of the facilities and equipment available for the various trades. They will be given adequate time to explore and familiarize themselves with the respective setups, equipment, tools, and processes associated with each trade. After gaining an understanding of the available setups, each applicant will be required to select one trade of their choice for the trade Test. The trade selected by the applicant will be considered final and no subsequent change will be permitted. Once the trade has been selected, the applicant will be assigned specific practical tasks related to the chosen trade. The applicant will be required to complete the assigned tasks and demonstrate the necessary technical knowledge, practical skills, accuracy, and competence in the selected trade. The applicant's performance in the assigned tasks will be evaluated. Top 5 candidates will be called for an interview.

(c) Trade Test (Stage 3)

An interview will be conducted for the five shortlisted candidates. Based on their performance in the interview, one candidate will be selected for appointment. The remaining candidates will be placed on the waitlist in the order of merit.

Annexure 1
Syllabus for written exam - Recruitment of Technical Officer (Workshop Superintendent)

1. Strength of Materials

- **Stresses and Strains:** Rigid and deformable bodies – Tensile, compressive and shear stresses – Hooke's law and stress–strain diagram – Elastic constants: Young's modulus, shear modulus and bulk modulus – Poisson's ratio – Thermal stresses – Compound bars under axial loading.
- **Shear Force and Bending Moment:** Shear force and bending moment diagrams for statically determinate beams (cantilever, simply supported and overhanging) – Relationship between load, shear force and bending moment.
- **Stresses in Beams:** Theory of simple bending: assumptions and derivation of the bending equation – Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular (solid and hollow), I, T, angle and channel sections – Design of simple beam sections – Shear stress: derivation of formula and distribution across rectangular, circular, triangular, I and T sections.
- **Theories of Failure:** Maximum principal stress theory – Maximum shear stress theory – Maximum principal strain theory – Maximum strain energy theory – Maximum distortion energy theory.

2. Computer Aided Design

- **Transformations in Computer Graphics:** 2D and 3D geometric transformations: translation, scaling, rotation, reflection and shearing – Parallel and perspective projections.
- **Modelling of Curves and Surfaces:** Non-parametric and parametric curves – Cubic spline, Bézier, B-spline and NURBS curves – Surface of revolution, sweep surface, linear Coons surface, Bézier surface and B-spline surface.
- **Geometric Modelling of 3D Objects:** Boundary Representation (B-Rep) – Constructive Solid Geometry (CSG) – Data structures for B-Rep and CSG models – Hybrid solid modellers – Feature-based part modelling – Feature extraction from CAD models.
- **Product Data Exchange:** Neutral file formats – Exchange of product data using IGES and STEP.

3. Conventional Manufacturing Practices

- **Fitting and Fabrication:** Layout marking, filing, scraping, drilling, reaming and tapping – Assembly with fits and tolerances – Sheet-metal development – Carpentry and joinery.
- **Welding:** Gas welding and cutting – SMAW, MIG, TIG, SAW and resistance welding – Soldering and brazing – Weld defects and non-destructive testing (NDT).
- **Foundry and Forging:** Patterns, sand testing, cores, gating and risering – Casting defects – Hand, power, drop and press forging.
- **Heat Treatment and Material Testing:** Heat treatment of carbon steels – Surface hardening – Hardness, tensile and impact testing.

- **Turning:** Operations on centre, capstan and turret lathes – Turning, facing, taper turning, knurling, parting and thread cutting – Work-holding devices: chucks, collets, face plates and rests.
- **Milling, Shaping and Grinding:** Up-milling, down-milling, slab milling, end milling, slotting and keyway cutting – Direct, simple, compound and differential indexing for gear cutting – Shaping of flats, dovetails and T-slots – Surface, cylindrical and centreless grinding – Wheel mounting, balancing, truing and dressing.

4. Automated Manufacturing Systems

- **CNC Programming and Machining:** Coordinate systems: Cartesian, machine zero and work zero – Absolute and incremental positioning – G-code and M-code programming for 2-axis CNC lathe and 4-axis CNC vertical machining centre (VMC) – Tool length and cutter radius compensation – Canned cycles for turning, facing, drilling, taper turning and tapping – Workpiece clamping, dialling-in, edge finders and tool presetting.
- **Fluid Power Automation:** Compressors, hydraulic power units, pumps, reservoirs, filters, pressure switches and safety relief systems as per ISO 1219 – Directional control valves (3/2, 5/2, 5/3), proportional valves, servo valves, flow control valves and check valves – Electro-hydraulic and electro-pneumatic sequencing circuits.
- **Robotics:** Robot configurations – Forward and inverse kinematics – Robot programming.
- **Unmanned Aerial Vehicles (UAV):** Types of UAVs – Performance characteristics – Payloads – Applications.
- **Additive Manufacturing (AM):**
    - *Classification and Technology:* Classification based on materials and mechanisms – AM process chain – Part orientation, model slicing, support generation, tool path generation and file conversion – Printing and post-processing.
    - *Design for Additive Manufacturing (DfAM):* Design for Manufacturing and Assembly – Unique capabilities of AM – Core DfAM concepts and objectives – Design freedom – General DfAM methods.
    - *Fused Deposition Modelling (FDM):* Working principle – Filament types and multi-nozzle printers – Printing and post-processing – Process parameters, optimisation and applications.
    - *Powder-Based Additive Manufacturing:* Materials – Powder bed fusion mechanisms – Selective Laser Sintering (SLS) – Process parameters and modelling – Powder handling – Process variants.
    - *Metal Additive Manufacturing:* Classification of metal AM – Laser Powder Bed Fusion (L-PBF), Directed Energy Deposition (DED), Selective Laser Melting (SLM), Laser Engineered Net Shaping (LENS) and Wire Arc Additive Manufacturing (WAAM): material processing, working principle, post-processing, applications and limitations.

5. Metrology, Inspection and Instrumentation

- **Metrology:** Direct reading instruments: Vernier Caliper, Micrometer and Depth Gauge – Angular measurement: Universal bevel protractor, Sine bar and Slip gauges – Mechanical, pneumatic and optical comparators – Dial test indicators (DTI) – Profile projectors – Coordinate Measuring Machines (CMM).
- **Limits, Fits, Gauges and Surface Roughness:** Indian Standard (IS) System of Limits and Fits – Hole-basis and shaft-basis systems – Taylor's principle of limit gauging – GO and NO-GO plug and snap gauges – Assessment of surface roughness.
- **Sensors and Transducers:** Operating principles, static and dynamic characteristics, and selection criteria – Proximity sensors (inductive, capacitive and optical) – Incremental and absolute encoders – Hall effect sensors – LVDTs – Thermocouples and RTDs – Strain gauges – Piezoelectric transducers.
- **Electrical Actuators:** DC motors – Brushless DC (BLDC) motors – Stepper motors (full-step, half-step and micro-stepping) – AC induction motors.
- **Drive Systems:** Analog-to-digital (ADC) and digital-to-analog (DAC) converters – Variable Frequency Drives (VFD) – PWM controllers – Servo drives and gain tuning – Position and velocity feedback loops – Dynamic braking.

Annexure 2

Syllabus for Trade Test – Technical Officer (Workshop Superintendent)

1. CAD / CAM

- 2D Drafting & Geometric Dimensioning and Tolerance (GD&T).
- Parametric 3D Solid and Surface Modelling.
- Core G & M Code Architecture & Interpolation.
- Advanced Canned & Fixed Cycle Programming.
- Parametric & Custom Macro Programming.
- Multi-Axis, Mill-Turn & High-Speed Machining.
- CAM Programming, Post-Processing & Virtual Verification.
- CNC Turning and Milling.

2. 3D Printing:

- 2D, 3D Solid and Surface Modeling and Assembly
- Fundamentals of Additive Manufacturing & Process Classification.
- 3D Printing File Formats & Design for Additive Manufacturing (DfAM)
- Slicing Software, Toolpath Planning & Process Parameters.
- Polymer & Metal 3D Printing Systems (Operation & Troubleshooting).
- Materials Engineering, Feedstock Handling & Characterization.

3. Industrial Automation:

- Electro-Pneumatic Circuit Assembly & Troubleshooting
- PLC & HMI Programming.
- Robot programming and operation
- VFD / Servo Drive Configuration & Motor Interfacing
- Sensor & Signal Conditioning Wiring & Calibration.