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RRB-JE

RAILWAY RECRUITMENT BOARD

JUNIOR ENGINEER

COMPUTER BASED TEST (CBT) - II

MECHANICAL & ALLIED ENGINEERING

Previous years Questions with Detailed Solutions,
Subjectwise & Chapterwise (2014, 2015 & 2019)

General Awareness | Physics & Chemistry | Basics of Computers & Applications
Basics of Environment & Pollution Control | Mechanical Engineering

SALIENT FEATURES:

- Explanations in detail with a focus on strategy
- Competency-based text approach
- Contains 2500+ Solved Questions
- Useful for SSC-JE & Other Competitive Examinations

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Foreword

Dear Students,

For the purpose of hiring Junior Engineers for the Indian Railways, the Railway Recruitment Board (RRB) Junior Engineer Examination is a combined two-stage exam that is followed by document verification (IR). A high number of applicants show up for this exam every two years, vying for a small number of open positions. Due to its low selection ratio and technical character, RRB-JE is therefore one of the most sought-after tests in India.



RRB-JE aspirants experience tremendous preparation pressure a few weeks before the real examination as they are not sure about the type of questions expected in the exam. It is very difficult to guess the possible questions in the competitive exam but there are ways to overcome this difficult situation. One such excellent option is solving the previous years' question papers as a part of the preparation strategy. Solving previous years' questions always gives a positive mindset before going to the real examination. This option may look simple and easy yet many aspirants do not include the practice of previous years' questions in their preparation.

The RRB-JE pattern consists of two stages: CBT-I and CBT-II, which are followed by document verification; the candidate must pass each level in order to advance to the next. General Intelligence and Reasoning, Quantitative Aptitude, General Science, and General Awareness are all included in the preliminary stage. The CBT-I is applicable here to all branches. The CBT-II second stage is an objective test for the corresponding engineering field.

We at ACE Engineering Academy came up with a series of books on previous questions and solutions for various competitive exams such as GATE, ESE, PSUs, and Other Government Recruitment Examinations. The latest offering in this series is **Railway Recruitment Board - Junior Engineer (RRB - JE) CBT - II Mechanical Engineering Examination** Questions and Solutions book. The unique feature in this book is that the available previous years' examination questions are categorized as subject-wise, chapter-wise so that the aspirant can integrate these questions along in their regular preparation.

We at ACE are sure that this book will be of tremendous help to the aspirants of RRB - JE CBT -II examination. Any suggestions or inputs which will add value are welcomed.

Thanks to all Professors who extended their services in the preparation of this booklet. It is believed that this volume is also a valuable aid to the students appearing for competitive exams like SSC-JE, Central & State Public Service Commissions & Various Competitive Examinations.

Wishing you Success in all your Endeavors

**Y.V. Gopala Krishna Murthy,
M Tech. MIE,
Chairman & Managing Director,
ACE Engineering Academy,
ACE Engineering Publications.
Frost Interactive Service Pvt. Ltd. (ACE ONLINE).**

RRB - JE Examination Pattern & Syllabus

RECRUITMENT PROCESS:

- Only single online application {common to all the notified posts in opted RRB - Junior Engineer (JE), Junior Engineer (Information Technology) [JE(IT)], Depot Material Superintendant (DMS) and Chemical & Metallurgical Assistant (CMA)} has to be submitted by the candidate through the link provided on the official website of RRBs.
- The entire recruitment process shall involve, 1st stage Computer Based Test (CBT), 2nd stage CBT, and Document Verification/Medical Examination as applicable. Selection is made strictly as per merit, on the basis of CBTs.
- The date, time and venue for all the activities viz CBTs and DV or any other additional activity as applicable shall be fixed by the RRB and shall be intimated to the eligible candidates in due course. Request for postponement of any of the above activity or for change of venue, date and shift will not be entertained under any circumstances.

1st Stage CBT (Common for all notified posts of this CEN):

Duration : 90 minutes (120 Minutes for eligible PwBD candidates accompanied with Scribe)

No. of Questions : 100

- The 1st stage CBT is of screening nature and the standard of questions for the CBT will be generally in conformity with the educational standards and/or minimum technical qualifications prescribed for the posts.
- The normalized score of 1st stage exam shall be used only for short listing of candidates for 2nd stage exam as per their merit.
- Candidates who are shortlisted for 2nd stage CBT availing the reservation benefits of a community, PwBD and ExSM shall continue to be considered only against that community for all subsequent stages of recruitment process.

The Questions will be of objective type with multiple choices and are likely to include questions pertaining to:

- (a) Mathematics:** Number systems, BODMAS, Decimals, Fractions, LCM and HCF, Ratio and Proportion, Percentages, Mensuration, Time and Work, Time and Distance, Simple and Compound Interest, Profit and Loss, Algebra, Geometry, Trigonometry, Elementary Statistics, Square Root, Age Calculations, Calendar & Clock, Pipes & Cistern.
- (b) General Intelligence and Reasoning :** Analogies, Alphabetical and Number Series, Coding and Decoding, Mathematical operations, Relationships, Syllogism, Jum-bling, Venn Diagram, Data Interpretation and Sufficiency, Conclusions and Decision Making, Similarities and Differences, Analytical reasoning, Classification, Directions, Statement – Arguments and Assumptions etc.
- (c) General Awareness :** Knowledge of Current affairs, Indian geography, culture and history of India including freedom struggle, Indian Polity and constitution, Indian Economy, Environmental issues concerning India and the World, Sports, General scientific and technological developments etc.
- (d) General Science :** Physics, Chemistry and Life Sciences (*up to 10th Standard CBSE syllabus*).

The section wise Number of Questions and Marks are as below :

| Subjects | No. of Questions | Marks for each Section | Duration |
|----------------------------------|------------------|------------------------|----------|
| | Stage-I | Stage-I | 90 Min |
| Mathematics | 30 | 30 | |
| General Intelligence & Reasoning | 25 | 25 | |
| General Awareness | 15 | 15 | |
| General Science | 30 | 30 | |
| Total | 100 | 100 | |

- The section wise distribution given in the above table is only indicative and there may be some variations in the actual question papers.
- Minimum percentage of marks for eligibility in various categories: UR -40%, OBC-30%, SC-30%, ST -25%. These percentage of marks for eligibility may be relaxed by 2% for PwBD candidates in case of shortage of PwBD candidates against vacancies reserved for them.

2nd Stage CBT:

Duration : 120 minutes (160 Minutes for eligible PwBD candidates accompanied with Scribe)

No. of Questions : 150

- Short listing of Candidates for the 2nd Stage CBT exam shall be based on the normalized marks obtained by them in the 1st Stage CBT Exam.
- Total number of candidates to be shortlisted for 2nd Stage shall be 15 times the community wise total vacancy of Posts notified against the RRB as per their merit in 1st Stage CBT.
- However, Railways reserve the right to increase/decrease this limit in total or for any specific category(s) as required to ensure availability of adequate candidates for all the notified posts.

Syllabus: The Questions will be of objective type with multiple choices and are likely to include questions pertaining to General Awareness, Physics and Chemistry, Basics of Computers and Applications, Basics of Environment and Pollution Control and Technical abilities for the post. The syllabus for General Awareness, Physics and Chemistry, Basics of Computers and Applications, Basics of Environment and Pollution Control is common for all notified posts under this CEN as detailed below:-

- General Awareness :** Knowledge of Current affairs, Indian geography, culture and history of India including freedom struggle, Indian Polity and constitution, Indian Economy, Environmental issues concerning India and the World, Sports, General scientific and technological developments etc.
- Physics and Chemistry:** Up to 10th standard CBSE syllabus.
- Basics of Computers and Applications:** Architecture of Computers; input and Output devices; Storage devices, Networking, Operating System like Windows, Unix, Linux; MS Office; Various data representation; Internet and Email; Websites & Web Browsers; Computer Virus.
- Basics of Environment and Pollution Control:** Basics of Environment; Adverse effect of environmental pollution and control strategies; Air, water and Noise pollution, their effect and control; Waste Management, Global warming; Acid rain; Ozone depletion.
- Technical Abilities:** The educational qualifications mentioned against each post shown in Annexure-A, have been grouped into different exam groups as below. Questions on the Technical abilities will be framed in the syllabus defined for various Exam Groups given at Annexure-VII-A, B, C, D, E, F & G.

The section wise Number of Questions and Marks are as below :

| Subjects | No. of Questions | Marks for each Section | Duration |
|---|------------------|------------------------|----------------|
| | Stage-II | Stage-II | |
| General Awareness | 15 | 15 | 120 Min |
| Physics & Chemistry | 15 | 15 | |
| Basics of Computers and Applications | 10 | 10 | |
| Basics of Environment and Pollution Control | 10 | 10 | |
| Technical Abilities | 100 | 100 | |
| Total | 150 | 150 | |

- The section wise distribution given in the above table is only indicative and there may be some variations in the actual question papers.
- Minimum percentage of marks for eligibility in various categories: UR-40%, OBC-30%, SC-30%, ST-25% This percentage of marks for eligibility may be relaxed by 2% for PwBD candidates, in case of shortage of PwBD candidates against vacancies reserved for them.
- Virtual calculator will be made available on the Computer Monitor during 2nd Stage CBT.

Discipline Mapping Tables:-

| Three years Diploma in Engineering or Bachelor's Degree in Engineering/Technology | Exam Group |
|---|-----------------------------------|
| Mechanical Engineering | Mechanical and Allied Engineering |
| Production Engineering | |
| Automobile Engineering | |
| Manufacturing Engineering | |
| Mechatronics Engineering | |
| Industrial Engineering | |
| Machining Engineering | |
| Tools and Machining Engineering | |
| Tools and Die Making Engineering | |
| Combination of any sub stream of basic streams of above disciplines | |
| Electrical Engineering | Electrical and Allied Engineering |
| Combination of any sub stream of basic streams of Electrical Engineering | |

| Three years Diploma in Engineering or Bachelor's Degree in Engineering/Technology | Exam Group |
|--|------------------------------------|
| Electronics Engineering | Electronics and Allied Engineering |
| Instrumentation and Control Engineering | |
| Communication Engineering | |
| Computer Science and Engineering | |
| Computer Engineering | |
| Computer Science | |
| Information Technology | |
| Combination of sub streams of basic streams of above disciplines | |
| Civil Engineering | Civil and Allied Engineering |
| Combination of sub streams of basic streams of Civil Engineering | |
| B.Sc., in Civil Engineering of 3years duration | |
| Printing Technology/Engineering | Printing Technology |

| S. No. | Education Qualifications | Exam Group |
|---------------|---|---|
| 1. | B.Sc., Chemistry and Physics | CMA |
| 2. | BE/B.Tech., (Computer Science) | Computer Science and Information Technology |
| | BE/B.Tech., (Information Technology) | |
| | PGDCA | |
| | B.Sc. Computer Science | |
| | BCA | |
| | DOEACC "B" Level Course of 3 years duration or equivalent | |

All the candidates with the above qualification shall be tested in the Exam Group mapped as per the above chart. However, candidates with educational qualification of BE/B.Tech (Computer Science) or BE/B.Tech (Information Technology), applying for both the posts of JE(S&T Department) and JE (IT), have to opt for either Electronics and Allied Engineering Exam Group or Computer Science and Information Technology Exam Group. The educational qualification for the post of DMS (Depot Material superintendent) is Three Years Diploma in Engineering i.e a candidate with Three Years Diploma in any of Engineering disciplines, can apply for these posts as applicable. Candidates with educational qualifications not figuring in the above chart and eligible for DMS posts have to choose any one of the above listed Exam Groups other than CMA Exam Group, during the registration for online applications of this CEN.

A candidate possessing more than one minimum educational qualification, mapped to different Exam Groups, can choose any one Exam Group. These candidates would be eligible for all the posts for which they possess minimum educational qualifications.

Syllabus for Mechanical & Allied Engineering

1. Engineering Mechanics :

Resolution of forces, Equilibrium and Equilibrant, parallelogram law of forces, triangle law of forces, polygon law of forces and Lami's theorem, couple and moment of a couple, condition for equilibrium of rigid body subjected to number of coplanar non-concurrent forces, definition of static friction, dynamic friction, derivation of limiting angle of friction and angle of repose, resolution of forces considering friction when a body moves on horizontal plane and inclined plane, calculation of moment of inertia and radius of gyration of : (a) I-Section (b) channel section (c) T-Section (d) L-Section (Equal & unequal lengths) (e) Z-Section (f) Built up sections (simple cases only), Newton's laws of motion (without derivation), motion of projectile, D'Alembert's principle, definition law of conservation of energy, law of conservation of momentum.

2. Material Science :

Mechanical properties of engineering materials – tensile strength, compressive strength, ductility, malleability, hardness, toughness, brittleness, impact strength, fatigue, creep resistance. Classification of steels, mild steel and alloy steels. Importance of heat treatment. Heat treatment processes – annealing, normalizing, hardening, tempering, carburizing, nitriding and cyaniding.

3. Strength of Materials :

Stress, strain, stress strain diagram, factor of safety, thermal stresses, strain energy, proof resilience and modules of resilience. Shear force and bending moment diagram – cantilever beam, simply supported beam, continuous beam, fixed beam. Torsion in shafts and springs, thin cylinder shells.

4. Machining :

Working principle of lathe. Types of lathes – Engine lathe – construction details and specifications. Nomenclature of single point cutting tool, geometry, tool signature, functions of tool angles. General and special operations – (Turning, facing, taper turning thread cutting, knurling, forming, drilling, boring, reaming, key way cutting), cutting fluids, coolants and lubricants. Introduction to shaper, slotter, planer, broaching, milling and manufacture of gears, heat treatment process applied to gears.

5. Welding :

Welding – Introduction, classification of welding processes, advantages and limitations of welding, principles of arc welding, arc welding equipment, choice of electrodes for different metals, principle of gas (oxy-acetylene) welding, equipment of gas welding, welding procedures (arc & gas), soldering and brazing techniques, types and applications of solders and fluxes, various flame cutting processes, advantages and limitations of flame cutting, defects in welding, testing and inspection modern welding methods, (submerged, CO₂, atomic – hydrogen, ultrasonic welding), brief description of MIG & TIG welding.

6. Grinding & Finishing Process :

Principles of metal removal by grinding, abrasives, natural and artificial, bonds and binding processes, vitrified, silicate, shellac rubber, grinding machines, classification: cylindrical, surface, tool & cutter

grinding machine, construction details, relative merits, principles of centreless grinding, advantages & limitations of centreless grinding work, holding devices, wheel maintenance, balancing of wheels, coolants used, finishing by grinding, honing, lapping, super finishing, electroplating, basic principles – plating metals, applications, hot dipping, galvanizing tin coating, parkerising, anodizing, metal spraying, wire process, powder process and applications, organic coatings, oil base paint, lacquer base enamels, bituminous paints, rubber base coating.

7. Metrology :

Linear measurement – Slip gauges and dial indicators, angle measurements, bevel protractor, sine bar, angle slip gauges, comparators (a) mechanical (b) electrical (c) optical (d) pneumatic. Measurement of surface roughness; methods of measurements by comparison, tracer instruments and by interferometry, collimators, measuring microscope, interferometer, inspection of machine parts using the concepts of shadow projection and profile projection.

8. Fluid Mechanics & Hydraulic Machinery :

Properties of fluid, density, specific weight, specific gravity, viscosity, surface tension, compressibility capillarity, Pascal's law, measurement of pressures, concept of buoyancy. Concept of Reynold's number, pressure, potential and kinetic energy of liquids, total energy, laws of conservation, mass, energy and momentum, velocity of liquids and discharge, Bernoulli's equation and assumptions, venturimeters, pitot tube, current meters. Working principle & constructional details of centrifugal pump, efficiencies – manometric efficiency, volumetric efficiency, mechanical efficiency and overall efficiency, cavitation and its effect, working principle of jet & submersible pumps with line diagrams.

9. Industrial Management :

Job analysis, motivation, different theories, satisfaction, performance reward systems, production, planning and control, relation with other departments, routing, scheduling, dispatching, PERT and CPM, simple problems.

Materials in industry, inventory control model, ABC Analysis, Safety stock, re-order, level, economic ordering quantity, break even analysis, stores layout, stores equipment, stores records, purchasing procedures, purchase records, Bin card, Cardex, Material handling, Manual lifting, hoist, cranes, conveyors, trucks, fork trucks.

10. Thermal Engineering :

Laws of thermo dynamics, conversion of heat into work vice versa , laws of perfect gases, thermo dynamic processes – isochoric, isobaric, isothermal hyperbolic, isentropic, polytrophic and throttling, modes of heat transfer, thermal conductivity, convective heat transfer coefficient, Stefan Boltzman law by radiation and overall heat transfer coefficient.

Air standards cycles – Carnot cycle, Otto cycle, Diesel cycle, construction and working of internal combustion engines, comparison of diesel engine and petrol engine. Systems of internal combustion engine, performance of internal combustion engines.

Air compressors their cycles refrigeration cycles, principle of a refrigeration plant.

**Previous RRB - JE Questions with Detailed Solutions,
Subjectwise & Chapterwise**

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Mechanical and Allied Engineering

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