

Recruitment of professionals on contract basis

BITES Ltd., a Mini Ratna Central Public Sector Enterprise under the Ministry of Railways, Govt. of India is a premier multi-disciplinary consultancy organization in the fields of transport, infrastructure and related technologies.

BITES Ltd. is in urgent need of dynamic and hard working professionals as under:

VC No.	Post	No. of Vacancies					
		UR	EWS	OBC (NCL)	SC	ST	Total
50/22	Tunnel Ventilation and E&M Expert	-	-	-	-	1	1*
51/22	Geophysicist	1	-	-	-	-	1
52/22	Tunnel Construction Engineer	1	-	-	1	-	2*
53/22	Tunnel Design Engineer	-	-	-	1	1	2

*Includes Backlog Vacancies

Age Limit

Maximum Age	Cut-off date for calculation of Age
40 Years	01.09.2022

Minimum Qualifications & Experience

VC No	Designation	Minimum Qualification*	Minimum post - qualification experience
50/22	Tunnel Ventilation and E&M Expert (Rs. 60,000 – 1,80,000)	BE/B.Tech/B.Sc (Engg) Degree in Electrical/ Electrical & Electronics Engg	7 Years
Experience is defined as under:			
The candidate should have experience in Design of Tunnel Ventilation and E&M for Railway/Highway projects.			
51/22	Geophysicist (Rs. 60,000 – 1,80,000)	M.Sc./M.Tech i.e. Masters degree in Geophysics	7 Years
Experience is defined as under:			
The candidate should have experience as Geophysicist in ERT, SRT and MASW for Railway/Highway tunnels preferably in Hilly terrain (Himalayan Region).			
52/22	Tunnel Construction Engineer (Rs. 60,000 – 1,80,000)	BE/B.Tech/B.Sc (Engg) Degree in Civil Engg.	7 Years
Experience is defined as under:			
The candidate should have experience of supervision of Tunnel Construction for Railway/Highway. Construction supervision of tunnels executed with NATM methodology will be preferred.			

VC No	Designation & Pay Scale (Rs.)	Minimum Qualification*	Minimum post - qualification experience
53/22	Tunnel Design Engineer (Rs. 50, 000 – 1, 60, 000)	BE/B.Tech/B.Sc (Engineering) Degree in Civil Engineering	4 years
Experience is defined as under:			
The candidate should have experience in Design of Tunnel for Railway/Highway. Experience of tunnel design in NATM methodology will be preferred.			

*Candidate belonging to General/ EWS category (and candidates belonging to SC/ST/OBC(NCL)/PWD applying against unreserved posts) should have first class degree/ minimum 60% marks in Minimum Qualification for consideration against unreserved posts.

Reserved category candidates (SC/ST/OBC(NCL)/PWD as applicable) should have at least 50% marks in Minimum Qualification for consideration against reserved posts.

Experience shall be calculated as on 01.09.2022.

Note for Educational Qualification:

The candidate should possess Degree recognized by AICTE; from a University incorporated by an Act of Central or State legislature in India or other Educational Institutions established by an Act of Parliament or declared to be Deemed as University under Section 3 of the University Grants Commission Act, 1956. Sections A & B examination of the Institution of Engineers (India) which is treated as equivalent to Degree by Govt. of India, and recognized by AICTE shall also be accepted.

Relaxations & Concessions

Reservation/ relaxation/ concessions to EWS/ SC/ST/OBC (NCL)/PWD/ Ex-SM/ J&K Domicile would be provided against reserved posts (where applicable) as per extant Govt. orders.

Relaxation in upper age limit to OBC (NCL)/ SC/ ST/ PwD candidates shall be provided against reserved posts as per extant Govt. orders.

PWD candidates suffering from not less than 40% of the relevant disability shall only be eligible for the benefit of PWD. Such PWD candidates shall be eligible for relaxation of 10 years in upper age limit.

PWD candidates will have to meet the Physical Requirements and Functional Classifications which have been identified for the post as under:

Designation	Categories for which identified	Functional Classification	Physical Requirements
Tunnel Construction Engineer & Tunnel Design Engineer	Locomotor disability	OA, OL, Leprosy Cured, Acid Attack Victims	S, ST, BN, W, SE, MF, C, R, W, KC, CL, JU, H, RW
	Hearing Impairment	HI	

Designation	Categories for which identified	Functional Classification	Physical Requirements
Tunnel Ventilation and	Locomotor disability	OA, OL, Leprosy Cured,	S, ST, BN, W, SE, MF, C, R, W, KC,

E&M Expert		Acid Attack Victims	CL, JU, H, RW
	Hearing Impairment	HI	

Designation	Categories for which identified	Functional Classification	Physical Requirements
Geophysicist	Locomotor disability	OA, OL	S, ST, BN, W, SE, MF, C, R, W, RW
	Hearing Impairment	HI	

Functional Classification & Physical Requirement:

Code	Functional Classification	Code	Physical Requirements
OH	Orthopaedically Handicapped	S	Sitting
VH	Visually Handicapped	ST	Standing
HH	Hard of Hearing	W	Walking
OL	One leg	SE	Seeing
OA	One arm	H	Hearing/ Speaking
BA	Both Arms	RW	Reading and Writing
BH	Both Hands	C	Communication
MW	Muscular Weakness	MF	Manipulation by fingers
OAL	One arm one leg	PP	Pulling & Pushing
BLA	Both Legs and Arms	L	Lifting
BLOA	Both Legs one Arm	KC	Kneeling & Crouching
LV	Low Vision	BN	Bending
B	Blind	M	Movement
PD	Partially Deaf	JU	Jumping
FD	Fully Deaf	CL	Climbing
BL	Both legs		
D	Dwarfism		
CP	Cerebral Palsy		
LC	Leprosy Cured		
AAV	Acid Attack Victims		
MD	Multiple Disabilities		

The above list is subject to revision.

Selection Process

On the basis of applications received, eligible candidates will be required to appear in the written test (Off-Line/On-Line). The candidates may be shortlisted for selection on the basis of performance in the written test. The company reserves the right to shortlist the number of candidates for selection out of eligible candidates. Due to prevalent pandemic situation, based on the requirement and discretion of RITES, selection process may be conducted online.

Based upon the performance in the Written Test, and fulfilling the conditions of eligibility; candidates shall be shortlisted for Interview.

The weightage distribution of various parameters of the selection shall be as under:

Experience	-	5%
Written Test	-	60%

Interview	-	35%
(Technical & Professional proficiency - 25 %; Personality Communication & Competency – 10%)		
Total	-	100%

A minimum of 50% marks for UR/EWS (45% for SC/ST/OBC (NCL)/ PWD against reserved posts) in written test and a minimum of 60% marks for UR/EWS (50% for SC/ST/OBC (NCL)/ PWD against reserved posts) in interview will be required to enable the candidate to be considered for placement on panel. There will be no minimum qualifying marks required in the aggregate.

Appointment of selected candidates will be subject to their being found medically fit in the Medical Examination to be conducted as per RITES Rules and Standards of Medical Fitness for the relevant post.

Candidates have the option to appear for interview either in Hindi or English.

Nature & Period of Engagement

The appointment shall be purely on contract basis initially for a period of one year, extendable until completion of the assignment subject to mutual consent and satisfactory performance.

Selected candidates shall be liable for posting anywhere in India as per Company requirements.

Remuneration

Pay, allowances and perks for the post would be as under:

The selected candidates would be paid Basic pay and DA, fixed/variable allowances @ 23% of Basic Pay, HRA/Lease, Contribution to PF, Gratuity as per Payment of Gratuity Act. Other benefits would be as under:

- | | | |
|--|---|--|
| <ul style="list-style-type: none"> a. Leaves b. Maternity Leave/ Paternity Leave c. Medical facility. d. Accident/Death Insurance. e. Leave Encashment. | } | As per company rules applicable to Contract employees. |
|--|---|--|

The approximate CTC for the posts of Tunnel Construction Engineer, Tunnel Ventilation and E&M Expert & Geophysicist is 14.8 LPA.

The approximate CTC for the posts of Tunnel Design Engineer is 12.37 LPA.

Remuneration mentioned above is only indicative. Actual remuneration shall depend upon place of posting and other terms & conditions of appointment.

Fees

The candidates will have to deposit the under mentioned amount of fees during online application:

Category	Fee
General/OBC Candidates	Rs. 600/- plus applicable taxes
EWS/ SC/ST/ PWD Candidates	Rs. 300/- plus applicable taxes

For any difficulty/ queries regarding fee payment, candidates may contact on following only:

Helpdesk No: 011 – 33557000 Extension Code - 13221

Helpdesk e-mail id: pghelpdesk@hdfcbank.com

Note:

- a) Candidates should note that the fee submitted through any other mode except the mode specified, will not be accepted by RITES and such applications will be treated as without fee and will be summarily rejected.
- b) Persons with disabilities are given concession in the fee provided they are otherwise eligible for appointment. A PWDs candidate claiming age relaxation/fee concession will be required to submit along with their Detailed Application Form, certified copy of the PWD certificate as per latest GOI format.

How to Apply

1. **Before applying candidates should ensure that they satisfy the necessary conditions and requirements of the position.**
2. Interested candidates fulfilling the above laid down eligibility criteria are required to apply online in the registration format available in the Career Section of RITES website, <http://www.rites.com>.
3. While submitting the online application; the system would generate 'Registration No.' on top of online form filled up by the candidate. Note down this "Registration No." and quote it for all further communication with RITES Ltd.
4. While filling up the required details, candidates are advised to carefully and correctly fill the details of "Identity Proof". Candidates are also advised to note the same and ensure the availability of the same Identity Proof as it will be required to be produced in original at later stages of selection (if called).
5. **After filling up the required details under the "Fill/ Modify Application Form", click on "Make payment". The payment details show the amount to be paid to the bank based on your category.**

Applications without successful fee payment shall be treated as incomplete and shall be summarily rejected.

6. A copy of this online **APPLICATION FORM** containing the registration number is to be printed, signed, and furnished along with **SELF-ATTESTED COPIES** of the following documents in the given order only (from top to bottom) **At The Time Of Selection (If Called):**
 - a. 2 recent passport size colour photographs
 - b. High School certificate for proof of Date of Birth
 - c. Certificates of Academic & Professional qualifications and statements of marks of all the qualifications for all semesters/years (Xth, XIIth, Diploma/ Graduation/ Post-Graduation as applicable)
 - d. EWS/ SC/ST/OBC Certificate in the prescribed format by Govt. of India (if applicable)
 - e. Proof of Identity & Address (Passport, Voter ID, Driving License, Aadhaar Card etc)
 - f. PAN Card
 - g. Proof of different periods of experience as claimed in the Application Form (if applicable)
 - h. Any other document in support of your candidature
 - i. PWD Certificate as per latest format (if applicable).
7. **No documents are to be submitted at present. Candidates may be asked to submit relevant documents at a later stage if so required.**
8. Please keep copies of experience certificates from your previous employment in respect of claims made by you in your application and are required to be produced at later stages of selection (if called). In respect of current employment, **experience certificate/ joining letter along with last months' salary slips, or, Form**

16 and other documents which clearly prove your continuity in the job are to be attached. In case your claim is not established from the proofs submitted by you; your application is liable to be rejected. Please check your claims and certificates submitted by you carefully. Incomplete application, or, insufficient proof would entail rejection of your application. No claims would be entertained at a later stage.

9. For proof of CTC/ salary, candidates shall have to submit a copy of their last Form No. 16/ Earning Card/ salary slip/ Appraisal letter/ any other suitable document.
10. Community certificate (SC/ST/OBC NCL) should be in the format prescribed by Government of India only. OBC candidates included in the Central List with certificate not more than 12 months old (with clear mention of candidate not belonging to "Creamy Layer") in the GOI prescribed format only will be considered for the posts reserved for OBC. EWS certificate should also be as per Gov. of India format.
11. The candidates are also advised to keep a copy of Application Form with them and to carry the same at the time of the Interview (if called).
12. The **original testimonials/documents along with one self-attested copy** will have to be produced by the candidate(s) at the time of selection (if called).
13. Applications received after the last date of receipt of Application Form and documents shall be rejected. RITES Ltd. does not bear any responsibility for any delay for any reason whatsoever.
14. Departmental candidates of RITES and candidates working in Government Departments/ PSU shall be allowed to join RITES only after being properly relieved from their parent organization.
15. Candidates not fulfilling the minimum laid down criteria advertised with respect to educational qualifications, age, and experience for selection to the respective post, would not be able to register online.
16. Candidates should submit only single online application for one vacancy and details once submitted in the application form cannot be altered. A valid e-mail ID is essential for submission of the online application. RITES will not be responsible for bouncing of any e-mail sent to the candidates.
17. If any claim made by a candidate is found to be incorrect, his/her candidature shall be summarily rejected.

Venue & Time

S. No.	Selection Round	Venue & Date
1	Written Test	6 different locations across India* (Exact address shall be communicated to the candidates later)
2	Personal Interview/ Document Verification (Subject to performance in Written Test)	Venue for the selection shall be communicated to the shortlisted candidates

Candidates are required to give two preferences for their choice of center for the Written Test at the time of online application. Although efforts shall be made to allot a center of choice to the candidates, however RITES reserves the right to allot to a candidate a center which was not indicated as his preference.

Test Centers for Written Test*:

S. No.	City
1	Delhi/Gurgaon
2	Kolkata

3	Chennai
4	Mumbai
5	Hyderabad
6	Nagpur

***All centers except Delhi/ Gurgaon are tentative and will depend on number of candidates and discretion of RITES.**

Exact Date, time and details of venue of the selection shall be communicated to shortlisted candidates.

Syllabus for Written Test

Syllabus for written test for the post of Geophysicist (VC No. 51/22)

1. Introduction:

- a) Basic Principle of Geophysics, Application and choice of different Geophysical method.
- b) Classification of different Geophysical exploration method.
- c) Geophysical method of prospecting for Civil Engineering application
- d) Utility and importance of the techniques
- e) Gravity & Magnetic methods and its application
- f) Electrical and Electromagnetic prospecting and its applications, use and benefits
- g) Seismic Survey for shallow and deep exploration its use applications and benefits
- h) Application of borehole Geophysics for subsurface investigations.
- i) Airborne Geophysics and its applications

2. Gravitational Method

Fundamental principle and Phenomenon ; gravitational Constant; weight of the earth; factors causing variation in Gravity, Bouger Correction; Isostasy; density of material; Quantities measured in Gravity survey Theory & Interpretation. Different types of Gravimeter used for gravity prospecting.

3. Magnetic Method

Physical concept of Magnetic method; Law of Forces; Unit field strength and Magnetic fields; Permeability and susceptibility; magnetic field strength; terrestrial Magnetism; Magnetic gradients; distribution of Earth's Magnetic field; Horizontal and Vertical magnetic field; Latitude and longitudinal correction in magnetic data. Field procedure and interpretation of magnetic data. Susceptibility of Rocks and mineral ; Different types of magnetometer used for magnetic prospecting.

4. Electrical Method

Current flow in a homogeneous earth; Resistivity measurement; Resistivity and apparent resistivity; Principle of equivalence; Anisotropy in rocks; Current flow in a horizontally stratified earth; Schlumberger apparent resistivity; type curves; Two layer curves; Three- layer curves; Four- layer curves; Asymptotic values of Schlumberger curves; Principle of reduction; Schlumberger curve matching with Ebert Charts; Inversion of resistivity data; Resistivity sounding case study; Resistivity Profiling; 2D Electrical Resistivity Tomography; data processing and interpretation; Application of electrical methods for ground water and engineering Investigation. Different methods of Electrical Sounding and profiling.

Different types of Resistivity meter for subsurface investigation & interpretation of Electrical sounding and profiling data.

5. Seismic Method

Basic theories of Seismic prospecting; Wave propagation, velocities of elastic waves and elastic constant; Velocities of different earth's material; propagation of Seismic waves; refraction and Reflection Phenomenon; Refraction and Reflection method in seismic survey; Travel time curve; Dip calculations; Velocity – depth function; Type of seismic spread and shooting method; Continuous refraction profile; Raypath and depth relationship; Correlation of refraction ; Multiple refraction.

Seismic instrumentation recording & Storage system; Sampling; record length; Gain control; filters (high cut, low cut, band pass, Notch filter); phase effect; Phase analyzer; frequency analysis and wave propagation; Signal – Noise ratio.

Seismic refraction data acquisition, processing and interpretations; Data acquisition method ; Identification of Refracted waves; Picking of first arrivals; Data editing; Filtering ; T-D plot of refracted data; analysis of seismic data through critical distance (X_c) and time intercept (t_i) method; Velocity and depth analysis for two layer and three layer earth model; Application of Raypath theory in seismic refraction data processing; Inversion of Seismic refraction model and generation of 2D Seismic Tomogram; generation of layered earth model from the seismic tomogram.

Interpretation of Seismic sections in terms of Geology with identification of subsurface strata and its characteristics. Assessment of 'Q', RMR, Rock mass Strength (σ_c) , Dynamic Elastic properties of soil and rock.

Fundamentals of Cross hole; uphole and downhole seismic survey and its application in Engineering geophysics. Fundament of shear wave analysis through Multi Channel Analysis of Surface Waves (MASW). Benefits of seismic survey in geotechnical investigations.

6. Well logging

Application of Borehole Geophysics in Engineering Geophysical Investigation; Geophysical logging Instrumentation devices and probes/Sonde. Use of different types of well logging probes to evaluate Lithology & stratigraphic correlation; aquifers and associated rock conditions; Effective porosity; Bulk density; true resistivity; Specific yield of Unconfined Aquifer;

Type of well logging probes

- Electrical Probe (SP, Point resistance; Short normal 16"; Long normal 64" Lateral resistivity 18' 18")
- Natural Gamma probe
- Temperature and Caliper probe
- Gamma-gamma density probe
- Neutron logging
- Acoustic & Optical televiwer Logging
- Hydrofracturing and Insitu stress measurement
- Sonic logging (Vp & Vs) probe

Methodology and borehole preparation of for Well logging , Logging associated risk analysis precautionary measures prior to start the logging operation; Borehole Fluid resistivity/

conductivity for carrying out different logging operation. Interpretation of Logging data, correlation of different logs and calculation of different parameters through different logs and its application in Engineering Geophysics.

7. Knowledge about the recent development of new applications in Geophysics for site explorations:
- Air borne Time domain Electromagnetic (TEM) Method for exploration
 - Application of GPR (Ground Penetrating RADAR) for utility and other surface mapping.
 - Underwater shallow refraction survey using Air gun for underwater construction of tunnels and other infrastructures.
 - Ultrasonic Test for detection of cracks, voids in piers and abutment of old bridge structure.
 - Refraction Microtremor(ReMi) to obtain site-specific NEHRP/IBC Vs30 site classification for earthquake response study.

Syllabus for written test for the post of Tunnel Ventilation and E&M expert (VC No. 50/22)

Underground environment

Composition of atmospheric air, O₂ deficiency – causes, effects & detection, Underground environment: Composition, Underground gases- CO₂, CO, H₂S, NO_x, CH₄, Radon gas – properties, physiological effects on man, occurrence & detection, Assessment, monitoring and remedial measures- Sampling and analysis of air – Gas chromatography, IR gas analyzer.

Heat and Humidity

Sources of heat in underground space, Metabolism and heat balance in human body, physiological effects of heat and humidity, Psychrometry, Cooling power of air, Air conditioning – basic principles.

Dust

Sources, measurement equipment & techniques, control measures

Air flow through underground openings

Introduction, general energy balance equation, flow of viscous fluids, laminar and turbulent flow, resistance of smooth walled pipes, flow through ducts, shock resistance, pressure losses, determination of resistance in air ways (pressure drop and quantity of flow through field measurement)

Methods of Ventilation and Equipment

Natural ventilation – Causes, Natural Ventilation Pressure (NVP)-Calculation of NVP from air density, Motive column, other methods of determining NVP, Numerical problems, Mechanical ventilation- Types of fans, Centrifugal fan – theoretical head developed, theoretical characteristic curves, fan losses, actual characteristics curves of CF fan, fan efficiency, Axial-flow fan – drag and lift, characteristic curves, variable pitch fan., Fan laws, Selection of fan, installation of fan – forcing & exhaust, Fan drift, diffuser and evasee, series and parallel operation of fans, fan control, Booster fan – function of booster fan, installation, pressure gradient diagram and positioning, Auxiliary ventilation, Forcing and exhaust ventilation systems for tunnel & underground stations, Numerical problems, CFD Analysis, Design of transverse, semi-transverse &

longitudinal ventilation system in Tunnels as per international codal provisions (NFPA, UIC, PIARC, TSI Guidelines).

Signals and Systems

Representation of continuous and discrete-time signals, shifting and scaling operation, linear, time-invariant and causal systems, Fourier series representation of continuous periodic signals, sampling theorem, Fourier, Laplace and Z transforms.

Control Systems

Representation of continuous and discrete-time signals, shifting and scaling operation, linear, time-invariant and causal systems, Fourier series representation of continuous periodic signals, sampling theorem, Fourier, Laplace and Z transforms.

Planning & Design of Electrical Works

Internal & External Works. Estimation, installation, testing and commissioning of such works.

Lighting systems and fixtures in tunnels

Specifications, maintenance, emergency lighting, design of power supply and cable system for tunnels.

- Standards of ventilation tunnels made for different purposes.
- Planning & Design of ventilation system for Road/Railway tunnels.
- Preliminary design for Tunnel ventilation System (TVS) & Environment Control system (ECS).
- Tunnel Ventilation System SCADA (Supervisory control and data acquisition).
- Smoke Ventilation & Air Conditioning System.
- SES (Subway Environment Simulation) and CFD (Computational fluid dynamics) Simulations of Underground Metro/ Rail Stations and Tunnels.
- Supply and Extract Ventilation systems, Chilled water systems.

Syllabus for written test for the post of Tunnel Construction Engineer (VC No. 52/22)

Concept of Stress and Strain in Rock: Analysis of stress and strain, strain energy, stress-strain behaviour of isotropic and anisotropic rock, parameters influencing strength/stress-strain behaviour. Physical properties of the rock, strength properties of soil/rock (compressive, tensile, shear and tri-axial strength)

Classification systems in rock engineering; Basic terminology, Rock and Rock mass classification, Geological petro graphic, Index properties of rocks, Physical and Mechanical properties, Defects in rock mass, Elastic constants of rock; Insitu stresses in rock, Modes of failures of rocks, Objective of rock exploration, methods of rock exploration; by direct penetration, by geophysical processing, in-situ and laboratory tests. RQD, Bieniawski's RMR, Barton's Q-system, Hoek's-GSI, correlations between different classification systems; applications of rock mass classification in rock engineering.

Methods for determination of compressive strength, tensile strength, shear strength and triaxial strength of rock; Modulus of elasticity and Poisson's ratio of rock; Determination of in situ stresses in rock.

Rock strength and failure Rock strength, Types of failure, Theories of failure (Coulomb- Navier, Mohr, Griffith), Hoek and Brown Strength criteria for rocks with discontinuity sets, Absolute stress by bore hole

deformation method, Flat jack method, Propagation velocity method, Bearing capacity of foundations on rocks

Rock Slope Engineering: Slope failure causes and process; general modes of slope failure; parameters related to slope stability; basic approaches to slope stability analysis - circular, non-circular, planar, wedge and topping failures; monitoring of slope stability and stabilization techniques. Rock fall simulation, Landslide/avalanche mitigation.

ENGINEERING GEOLOGY

Igneous, sedimentary and metamorphic rocks, Rock alteration, rock mass deformation by folding action, faults: characteristics and influence on tunneling, joints and their relevance to tunneling, groundwater aspects, squeezing and swelling ground conditions, gases in rocks. rock temperatures, sloping ground surface conditions, tunneling in soft ground, classification of soft ground tunneling conditions, rock burst phenomena in tunnels.

TUNNEL ENGINEERING

Basic terminology and application, Site investigations, methods of excavation of tunnels, supports and stabilization, Construction control and maintenance, tunnel ventilation, control of ground water and gas

Underground Excavation: Tunnel, adit, shaft; parameters influencing location, shape and size, geological aspects. Planning and site investigations for Tunnel. Factors affecting choice of excavation technique, Tunneling Methods for soft ground tunneling, hard rock tunneling and cut and cover section.

Concepts/Principal of NATM, other tunneling philosophies etc, Assessment of behavior of tunneling media, deformation modulus and support pressure measurement, application of numerical modeling in design, earthquake effects on tunnels, design methods:

analytical methods, computational or numerical methods, empirical methods design of underground space in rock/soft ground instrumentation and monitoring of rockmass performance.

Rock support interaction analysis, use of rock mass classifications for estimating support requirement, classification of supports, temporary and permanent supports/ linings.

Engineering Applications:- Reinforcement of fractured and jointed rocks - Shotcreting, Bolting, Anchoring, Installation methods - Case studies. Rock bolting, Reinforcement of laminated rock

Grouting Methods, Tunnel Ventilation, Drainage system, Tunnel face stability

Syllabus for written test for the post of Tunnel Design Engineer (VC No. 53/22)

GEOMECHANICS

Concept of Stress and Strain in Rock: Analysis of stress and strain, strain energy, stress-strain behaviour of isotropic and anisotropic rock, parameters influencing strength/stress-strain behaviour. Physical properties of the rock, strength properties of soil/rock (compressive, tensile, shear and tri-axial strength)

Classification systems in rock engineering; Basic terminology, Rock and Rock mass classification, Geological petro graphic, Index properties of rocks, Physical and Mechanical properties, Defects in rock mass, Elastic constants of rock; Insitu stresses in rock, Modes of failures of rocks, Objective of rock exploration, methods of rock exploration; by direct penetration, by geophysical processing, in-situ and laboratory tests. RQD, Bieniawski's RMR, Barton's Q-system, Hoek's-GSI, correlations between different classification systems; applications of rock mass classification in rock engineering.

Methods for determination of compressive strength, tensile strength, shear strength and triaxial strength of rock; Modulus of elasticity and Poisson's ratio of rock; Determination of in situ stresses in rock

Rock strength and failure Rock strength, Types of failure, Theories of failure (Coulomb- Navier, Mohr, Griffith), Hoek and Brown Strength criteria for rocks with discontinuity sets, Absolute stress by bore hole deformation method, Flat jack method, Propagation velocity method, Bearing capacity of foundations on rocks

Rock Slope Engineering: Slope failure causes and process; general modes of slope failure; parameters related to slope stability; basic approaches to slope stability analysis - circular, non- circular, planar, wedge and topping failures; monitoring of slope stability and stabilization techniques. Portal design, Rock fall simulation, Landslide/avalanche mitigation.

ENGINEERING GEOLOGY

Igneous, sedimentary and metamorphic rocks, Rock alteration, rock mass deformation by folding action, faults: characteristics and influence on tunneling, joints and their relevance to tunneling, groundwater aspects, squeezing and swelling ground conditions, gases in rocks. rock temperatures, sloping ground surface conditions, tunneling in soft ground, classification of soft ground tunneling conditions, rock burst phenomena in tunnels.

TUNNEL ENGINEERING

Basic terminology and application, Site investigations, methods of excavation of tunnels, supports and stabilization, Construction control and maintenance, tunnel ventilation, control of ground water and gas

Underground Excavation: Tunnel, adit, shaft; parameters influencing location, shape and size, geological aspects. Planning and site investigations for Tunnel. Factors affecting choice of excavation technique, Tunneling Methods for soft ground tunneling, hard rock tunneling and cut and cover section.

Concepts/Principal of NATM, other tunneling philosophies etc, Assessment of behavior of tunneling media, deformation modulus and support pressure measurement, application

of numerical modeling in design, earthquake effects on tunnels, design methods: analytical methods, computational or numerical methods, empirical methods design of underground space in rock/soft ground instrumentation and monitoring of rockmass performance.

Rock support interaction analysis, use of rock mass classifications for estimating support requirement, classification of supports, design of temporary and permanent supports/ linings.

Engineering Applications:- Reinforcement of fractured and jointed rocks - Shotcreting, Bolting, Anchoring, Installation methods - Case studies. Rock bolting, Reinforcement of laminated rock

Grouting Methods, Tunnel Ventilation, Drainage system, Tunnel face stability

SOFTWARE:

- **Tunnel & Slope Design Software** RS2, PLAXIS, ROCLAB, ROCSUPPORT, SWEDGE, UNWEDGE, TOPPLE, ROCFALL, SLIDE, ADSEC-OASIS, other relevant FEM/DEM/FDM software, AutoCAD, Civil 3D, alignment Design (open rail/open road), STAAD.Pro

DESIGN

- **TBM Tunneling:** Tunnel segment Design, TBM types & methodology.
- **Seismic Design of Tunnel:** Pseudo-static analysis / Quasi-static / Dynamic analysis.

- **Shaft Design:** Bottom up, Top down, contiguous pile, secant pile, soldier pile, D-wall, etc
- **Retaining walls/ Structures design:**
- **Dewatering design.**
- **Design of tunnels as per shape and multiple openings or simulation of stresses using either photo-elastic models or using software like PLAXIS, ANSYS**
- **Tunneling in solid rocks; Full face tunneling without supports and with supports, Single stage mining methods and multi-stage classical methods of tunnel construction, shield tunneling Analysis and Design of horse-shoe shaped tunnels, Design of circular shape tunnels.**
- **Rock Foundation: Shallow and Deep investigation for foundation design and construction aspect, Slope Stability analysis, Mode of failures in rock. Design of slopes, Excavation in rock and stabilization concepts, Bearing capacity of foundations on rocks**
- **Codes:** IS codes, European codes, ISRM/ITA-tunnel manuals guidelines & international practice adopted. (NFPA,UIC,TSI,PIARC & similar practice adopted)

General Instructions

1. Management reserves the right to cancel/ restrict/ enlarge/ modify/ alter the selection/ recruitment process at any stage, without issuing any further notice or assigning any reason thereafter.
2. The number of vacancies may vary.
3. Departmental candidates of RITES and candidates working in Government Departments/ PSU shall be allowed to join RITES only after being properly relieved from their parent organization.
4. Before applying, the Candidates must satisfy themselves about their eligibility for the post applied for.
5. In case it is detected at any stage of recruitment that a candidate does not fulfill the eligibility norms and/or that he/she has furnished any incorrect/false information or has suppressed any material fact (s), his/her candidature is liable for cancellation. If any of these shortcomings is/are detected even after appointment, his/her services are liable to be terminated.
6. The period of training/internship shall not be counted towards post qualification experience.
7. Legal jurisdiction will be Delhi in case of any dispute
8. No train/bus fare / TA / DA shall be payable.
9. In case a candidate is found suitable for a lower post than for which he/she has applied, he/she shall only be considered for the post for which he/she has been found suitable by the selection committee.

Communication with RITES

Any information regarding this recruitment process would be made available on the e-mail address provided by the candidate at the time of registration and/or shall be uploaded on RITES website. Candidates are advised to periodically check the Career section of RITES website for further updates.

Candidates are encouraged to go through the detailed advertisement and read the "Frequently Asked Questions (FAQs)" uploaded on RITES website under Career section to solve their queries.

Queries if remaining should be sent to rectt@rites.com only and contain the following particulars:

- i. VC No.
- ii. REGISTRATION/ROLL NO.
- iii. NAME OF CANDIDATE IN FULL AND IN BLOCK LETTERS.
- iv. Valid email address as given in the application

Communications not containing above particulars shall NOT BE ATTENDED TO.

Any query/ issue should be brought to notice of RITES well in advance of the due date. RITES will not be responsible for non-submission of application due to issues brought to notice at the last moment.

Queries related to information already provided in the advertisement shall not be attended to.

Important Dates

S. No.	Particular	Date
1	Start date of online registration	02.09.2022
2	Last date of online registration	26.09.2022
3	Date of selection	To be notified later