

Revised Syllabus for 70% for Promotion from Gr.'C' to Gr.'B' Post of AEN/NR in Civil Engineering Department.

As per Railway Board's circular No. E(GP)2018/2/31 dated 19.03.2019 and Para 204.3 of IREM Vol.I, the Written examination shall comprise of one paper which shall have 100% Objective type multiple choice questions only. The paper will be of 100 marks and the distribution will be as under :-

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| (i) Technical Subject including Official Language Policy | : 70 marks. |
| (ii) Establishment and Financial Rules | : 30 marks. |
| (iii) Qualifying marks | : 60 marks |

Further, detail syllabus and its weight-age with respect to complete paper are as under :-

i. Technical Subject including Official Language Policy		
SN	Description/Subjects/Topic	Weightage w.r.t. complete paper
(A)	Civil Engineering (General)	
1	Surveying	3%
	<p>a) Types</p> <p>Chain and Compass survey- Basic principles; base lines; check lines; tick lines; perpendicular and oblique offsets; conventional signs; plotting of survey; true and magnetic bearings; open and closed traverses; recording plotting of traverse, closing errors.</p> <p>Plane Table Survey - Techniques of using Distomat and Total Stations. Method of setting layouts & curves using these equipments.</p> <p>Levelling - Level Lines - datum, bench marks, simple leveling, fly leveling; recording the levels in field book; method of reducing levels; arithmetical check; longitudinal and cross section contouring.</p> <p>Theodolite Survey- Types of theodolites; measurement of horizontal angles, vertical angles, magnetic bearings and deflection angles; prolonging a straight line; traversing by method of included angles; balancing the survey - closing errors; calculations- of latitude and departure.</p> <p>Modern Survey Techniques- Basic principles and types of surveys</p> <p>b) Curves- Elements of simple circular curves, setting out simple circular curves.</p>	

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	<p>c) Setout works- Setting out buildings, culverts, Central line of Railway alignment. Usage of GPS technology in setting out Centre line of Railway alignments.</p> <p>d) Care & custody of survey instruments- Handling of instruments-Transportation protection; permanent adjustments; repairs and periodical overhaul.</p>	
2.	Strength of Materials, Structural Designs & Drawings	3%
	<p>a) Strength of Materials : Stress, strain, Hooke's law, working stress, factor of safety; bending moment and shear force in simply supported beams and cantilevers; simple theory of bending.</p> <p>Structural Design & Drawing Drawings Different sizes of paper, folding and storage of drawing, plan, elevation, sections, isometric view.</p> <p>RCC Structures RCC, methods of design, Working Stress Method and Limit State Method.</p> <p>Steel Structures Rivets and welds. Sketch and detailing of connections different types of joints and strength determination.</p>	
3	Construction material:	3%
	Description, specification, properties and uses of building materials - stones, sand, timber, bricks, cement, lime, building hardware, paints varnishes, glasses, and tiles. Concrete; mix design, placing, compaction and durability.	
4	Foundation & Construction Engineering	3%
	<p>a) Soil Mechanics Different type of Soils, Three phase diagram and their relationships, IS classification of soil, index and engineering properties of soil, compaction, consolidation, shear strength. Specification and construction of earth work in embankment and cuttings.</p> <p>b) Foundation Engineering Functions of foundation, different type of foundations, open foundations, well foundations and pile foundation, determination of safe bearing capacity, stress and settlement analysis, method of reducing differential settlements.</p>	
(B)	Civil Engineering (Railways)	3%
1	Railway Surveys & Construction	
	Provisions in Engineering Code regarding - Classification of Surveys, Terms of Reference, Principles governing Railway alignment, Ruling gradients, Grade compensation for curves, Horizontal and vertical curves, Hill Surveys, Catch sidings, Tunnels, preparation of various maps and drawings, preparation of Survey reports for RECT, PECT and FLS, Project estimates.	
2	Railway Track	7%

	Description, specifications and functions of the structural elements; Rails, sleepers, fastenings, ballast, blanket, formation (embankment/ cutting), drainage system and other sub-structures; points and crossings; geometry and design features, and Track layouts.	
3	Maintenance of Permanent Way	7%
	<p>a) Duties: - Duties of Assistant Divisional Engineers; duties of SSE/JE (P.Way); SSE/JE (Works), SSE/JE (Bridges), Gangmates, Keymen, Trackmen, Gatekeeper.</p> <p>b) Maintenance of Permanent way:- Methods of maintenance; Machine packing, Systems of maintenance; overhauling, systematic through packing, picking ups lacks, Need Based Track Maintenance; Miscellaneous works; lifting and lowering of track, shallow/deep screening of ballast; Maintenance of drains, lubrication of rail joints; adjustment of creep, maintenance of level crossings, Maintenance of points and crossings, channel sleepers, track on bridges.</p> <p>c) Special Maintenance Works: Maintenance of short welded rails, long welded and continuous welded rails maintenance of Switch Expansion Joints, maintenance in electrified section; special precautions; maintenance of track circuited sections; special precautions. Welding of rail joints, type and classification of rail fractures and their analysis, USFD of rails.</p> <p>d) Design, Maintenance of curved track and realignment of curves Curvature, transitions, super elevation of curves, safe speeds, cant deficiency, cant excess, speed on curves with turnouts, realignments of curves, extra clearances on curves.</p> <p>e) Track tolerances and Track Monitoring Track tolerances, track monitoring by track-recording car, frequency of recording based on category, interpretation of track recording results and exception reports; analysis of TRC reports to improve track parameters, OM S and its frequency.</p> <p>f) Schedule of dimensions</p> <p>g) Formation treatment works for Railway embankments- various methods, and their advantages and disadvantages.</p> <p>h) Works Affecting Railway Safety and Opening New Works General- Reference to rules; works requiring sanction of the CRS and notice there for; application to the CRS - execution of works and Safety Certificates; documents to Accompany application; submission of Safety Certificate; deviations from plans approved by CRS; applications for running of new types of locomotive sand/or rolling stock and for increase in speed; notification to railway officials when opening works; works arising out of accidents including breaches; opening of new lines; infringements to Schedule of Dimensions - condonation; procedure thereof; movement of ODCs - types and procedure for sanction for movement, precautions during movements.</p>	
4	Large Scale Permanent Way renewals:	2%

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	Classification of routes and tracks; track renewal programs, factors governing permanent way renewal; planning, preparation for relaying; preliminary work; systematic operation for complete relaying; speed restrictions to be observed during relaying; post relaying work; classification and disposal of released materials.	
5	Railway Operation:	5%
	<p>a) General: Reference to G&SR types of signal sand their significance; rules for working of trains; block working rules-types, Introduction of temporary single line working.</p> <p>b) Engineering Restrictions and Indicators : General - Definitions: Responsibility of the Inspector in-charge; works of short duration; protection of line In block section and procedure for passing trains; works of long duration; temporary engineering fixed signals; arrangements prior to commencement of work; Indicators for speed restrictions; procedure for blocking lines for engineering purposes; works at times of poor visibility; temporary signals in emergency; periodical notices of engineering restrictions; permanent speed restriction; indicators, review of permanent speed restrictions.</p> <p>c) Level Crossings: General - Classification, Standard Specifications; normal position of gates; level crossing equipment. traffic end engineering gates; gate lodges; appointment of gatemen; duties of gatemen; maintenance of level crossings; examination of gate equipment and gate men in rules; level crossings register; road traffic census.</p> <p>d) Working of Trollies: General Instructions: rules for working; distinction between trollies, lorries and motor trollies; Certificate of competency; officials permitted to use trollies and lorries; responsibility for safe working; working at night or in bad weather; working on track circuited sections; conveyance of non-railway officials; trolley permits for private sidings; trolley refuges; protection; equipment on trollies and lorries; working of trollies and lorries in block section, in station limits.</p> <p>e) Ballast and material trains General - Rules for working; restrictions in running: ordering of ballast trains; issue of "Fit to run" certificate; equipment; testing of brakepower; working in block sections; running in Ghat section; loading and unloading from hopper wagons; planning of ballast and material train movements; training out materials and daily reports of ballast train working; charges for ballast trains; register of engineering vehicles.</p>	
6	Accidents:	2%
	Observance of rules; intimation of accidents by station masters; duties and responsibility of the engineering officials in the event of accident impairing through traffic, action at site, reporting details of accident-provisions of Accident Manual; action in case of derailments; examination of site and preparation of sketches; recording track and rolling stock measurements-accident	

	procedure: use of recorded data; restoration of through running; procurement and arrangement of labour and equipment; temporary arrangements at site of accident; trans shipment; funds required during emergencies; report on defects in track; action on receipt of reports of defective track; abnormal occurrence attributable to oscillation of locomotives; accidents not impairing through traffic; records of accidents.	
7	Maintenance of Bridges	5%
	<p>a) Maintenance of bridges : Responsibility of the Engineering officials, action to be taken after inspection of bridges; maintenance of substructure-abutments, piers, wing wall and return walls, maintenance of arches, dismantling of arches. Details of common repair techniques- cement pressure grouting, epoxy grouting, shotcreting/Guniting. Maintenance of RCC & PSC super structures - periodical maintenance, common defects and repair / strengthening techniques; maintenance of super structure (steel) girders - loss of camber in steel girders, cracks in steel works, strengthening of weak girders, replacement of loose rivets; maintenance of HSFG bolts, corrosion and its prevention, protective coatings by painting - periodicity and precautions, patch painting, ordinary paints - for severe and no severe corrosion, metallising & epoxy based paints, Maintenance of welded girders; maintenance of composite girders. Various defects in bed blocks and their remedies; maintenance of bearings; Precautions while carrying out maintenance works on bridges.</p> <p>b) Inspection of bridges: Classification of bridges-major, minor, important; Inspection of Bridges by Permanent Way and Works Inspectors, by Bridge Inspectors (SSE/JE- P.Way, Works, Bridges) –Periodicity/ schedule and details of inspection, record of bridge inspection, registers to be maintained by the Bridge Inspectors, Certificate of inspection. Inspection by Assistant Divisional Engineers - Bridge Inspection Register, Numerical Rating System (NRS), Unique Rating Number, Condition Rating Number, Overall Rating Number, Certificate by the Assistant Engineer. Details of Inspection of Bridge – foundations, Flooring, masonry in substructure, under-water substructure inspection, arch bridges, protection works and water ways, girder alignment and seating, structural condition of girders, track on the bridge and its approaches, trolley and safety refuges, foot paths, painting, marking HFL and danger level, providing foundation particulars and bridge name boards, flood records at important bridges, road over/under bridges, concrete bridges, special inspection during Monsoon, equipment required for inspection of bridges. Works connected with maintenance of bridges; painting of steel works, laying of bridge sleepers; replacing cracked bed blocks.</p>	
8	Inspection and Maintenance of Tunnels and Deep Cuttings:	3%
	<p>a) Tunnels- Inspection by Engineering officials, items to be covered in the Inspection, record of inspection, mobile staging for inspection, details of tunnel inspection, ventilation of tunnels, leakage in tunnel sand methods of correction, works connected with the maintenance of tunnels.</p> <p>b) Deep Cuttings - General, inspection register of vulnerable cuttings, points to be noted during Inspection of cuttings, action to be taken in the case of boulder drops, action to be taken after inspection of cutting, guarding of vulnerable cuttings.</p>	

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9	Track Management System:	1%
	Salient feature of TMS, pre-requisites for introducing TMS in division, advantage of TMS etc.	
10	Inspection and Maintenance of Building and Structures (Other than Bridges)	3%
	a) Inspection & Maintenance of buildings & structures (including steel structures). b) Building Registers c) Periodical maintenance of Works including repairs to leaky roof/water proofing of roofs. d) Standard Measurement Registers for Buildings. e) Dismantling of buildings/structures. f) Retro-fitting / structural repairs of existing weak buildings/structures. g) Seismic retro-fitting and repairs/strengthening of buildings/structures.	
11	Maintenance of sanitary and hygienic conditions in station and railway Colonies; water supply, drainage and sewerage	3%
	a) Sanitation: Formation of sanitation committee; Inspection by sanitation committee, sanitary arrangements in stations and colonies, drinking water wells-protection; Cleaning of wells; disinfection; prevention of Infectious diseases; disinfection of quarters. b) Water supply: Source of water supply; water sample analysis; open wells-sizes: pumping capacity, improving yield; shallow tube wells; deep tube wells; impounding reservoirs; storage capacity; flood discharge; record of water levels in wells; rainfall registers; high level storage tanks; precaution against pollution; pumps - types, selection, installation; aqueducts and pipelines-types, selection, laying, estimating requirements of water; layout of distribution systems; water supply from outside sources; maintenance and operation of water supply installation - responsibilities of Engineering department, Mechanical department and Electrical Department. c) Drainage and sewerage: Preparation of schemes of sewerage, sewage & waste water-collection and carriage, drainage systems, waterborne sewerage; sizes of sewers; sewage treatment systems; sewage disposals; sewage purification systems; surface drainage-layout, size of drains; disposal of sullage effluent; drainage of latrines; maintenance of sewerage and drainage systems; maintenance of open sullage drains; storm water drains; house connections; conservancy and sanitary arrangements; responsibilities of engineering staff. Storm water drains; disposal of sewage - river pollution and control; sewage treatment; land irrigation, septic tanks, primary clarifier, sludge and scum removal, trickling filters, activated sludge process, sludge digesting, principles of an aerobic digestion, sludge gas, sludge drying and disposal.	
12	Acquisition, management and disposal of land: General Codes/ Manuals, rules:	2%
	Ownership of Railway land; sanctioning authority for acquisition and relinquishment; Principles of acquisition and relinquishment; Procedure for acquisition and relinquishment; Land plans and schedule; Documents of Handing over and taking over Railway Land; Land Records-Responsibility and procedure for demarcation, verification of railway boundary, land plan etc. maintenance of right of way; religious structure. Management of railway Land-	

	leasing, licensing of land, way leave facility and easement rights, grow more food. Leasing licensing for merchants and vendors at stations, bulk oil installation. Encroachment and responsibly; rules for permission for construction of building near Railway land; instructions regarding cutting/trimming and sale of natural product like mature tree, dry trees within and outside railway boundary, near electric or telegraph lines , sale of grass right etc. Provisions of Land Acquisition in 'Railway Act 1989' and in 'Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation, and Resettlement Act 2013'	
13	Rehabilitation of Bridges	2%
	Reasons for Rehabilitation, special Strengthening, Imposition of speed restriction, Priority for rehabilitation of bridges, Special. Inspection, Site Data, Execution of rehabilitation works, Precautions when working on bridges; rebuilding of alterations to bridges - design and execution of bridge works; temporary arrangements; false work for erection of girders; assembly and erection of girders; cranes for erection of girders; testing of girders; proposal for strengthening existing girder spans: methods of regirdering major bridges Strengthening of foundations, Strengthening/rebuilding of substructure, shaken/displaced/ cracked bed blocks, distressed arch bridges, replacement of nonstandard girders, replacement of pipe culverts, distress in parapets, replacement of small opening, distress in superstructure.	
14	Rivers & Floods, pre monsoon precautionary measures and patrolling of Railway Lines:	2%
	<p>a) Rivers and Floods: General-behavior of rivers; past history of bridges, danger-level at bridges, watchman at important bridges, duties and equipment of bridge-watchmen; special inspection during monsoon, action to be taken in the case of weather warning, pitching stone, boulder and monsoon reserve; vigilance during floods; flood records during and after the monsoon; survey of the course of river. River protection works; types design, repairs . and maintenance records - rivers and floods. Flooded causeways / dips. Special precautions when track is submerged. Rivers and flood register, Flood Reports, rain fall data, provision of anemometer on bridges.</p> <p>b) Pre-monsoon precautionary measures: General- Precautions to be taken before monsoon, Vulnerable sections; materials for anticipated emergencies; monsoon emergency rakes: equipment tools, rail clusters, temporary bridge spans; protective works; Railway affecting works and tanks; RAW. Tablet, joint inspection of WAR/RAT, inspection and vigilance over railway affecting tanks during heavy rain; pre-monsoon, during monsoon.</p> <p>c) Monsoon and emergency patrol: Types of Patrolling, keymen's daily patrol, gang patrol during abnormal rain; night patrolling during monsoon, Security patrolling during civil disturbances and for movement of VIP specials, hot weather patrolling for LWR/CWR, stationary watchman at vulnerable points; Protection of line In case of Emergency, Commencement and termination, Preparation of Patrol Charts, Distribution of Patrol Charts, Patrol Books and Systematic Patrolling, duties of patrolmen and their equipment, review of patrolling systems and vulnerable locations, Selection of Patrolman, Certificate to be submitted by</p>	

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	P.W.I. (JE/SS (P.Way)), Duties of Patrolmen, reporting damage & obstruction on track to Station Masters: Action by AEN and PWI on receipt of information regarding damage to the line, checkover patrolling; inspection of equipment: surprise checking at night, responsibility of engineering officials in the matter of patrolling, vulnerable locations (Points).	
15	Preparation of Plans and Estimates: Preparation of plans: General procedure; plan for other departments; size of drawings; titles and numbering of drawings; scale of drawings; details on drawings; symbols and colours in drawings; RDSO drawings; CE's plans; Plans of Divisional/ Asst. Engineer's/Inspector's Offices; completion drawings; care and filing of tracings/Ferro/Prints; Preparations of estimates code rules; technical details, rates and quantities; schedule of rates and price - listing of stores; report - and justification; rent statement for staff quarters; special features of estimates for remodeling of station yards, track renewal works, deposit works: Urgency Certificate; Supplementary Estimates, Revised Estimates.	2%
16	Contract and Execution of Work: a) Contract: General-Code of reference for contracts; schedule of rates; analysis, non-schedules rates, tenders; types; tender documents, drawings and specifications, tender committees, acceptance of tenders, contracts; types, contract documents, General and special condition of contract ; measurement and measurement books-code reference; recording measurements; 'on account' and final measurements; standard measurements books ; responsibilities of Inspectors/JE/SSE) and Asst. Engineers for measurement of works; ballast measurement; computation quantities; preparation of abstract in measurement books; submission of bills; checking of bills; bill registers; Variations; PVC; Basics Of Arbitration. b) Execution of Work: General instructions - Code rules; agencies for executing works; responsibilities of executive officers; deposit works; excess and savings on estimates; attention to public interests; prevention of accidents; planning - activity, milestone, bar charts, critical path networks, PERT; departmental execution of work - record; progress reports, charges for stores and labour, execution of works In Engineering workshops; contracted works; issue of work orders; completion documents; zonal works.	3%
17	Miscellaneous: 1. Engineering plant: General - code rules; engineering plant reserve, plant register; valuation of plant; maintenance; storage and repairs; requisitioning of plants; use of plant at site; maintenance of log books; hiring out of engineering plant; examination of boilers of the engineering department. 2. Explosives: General - Issue of Instructions on use of explosives; observance of rule of carriage of explosives; commonly used explosives; selection of explosives;	2%

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	<p>storage and conveyance to work site; blasting operations; boring holes: amount of charge; preparation of charge; electrical and safety fuses: precaution to be observed during blasting; misfires; protection of trains and railway property; destruction of explosives; detonating signals - care and custody; use of detonators and test, competency certificates for handling explosives.</p> <p>3. Management of Engineering Stores: General - Reference to code and Rules; procurement of stores; requisition; receipt and issue of challans; claims of short receipts etc.; custody of stores- classification, handling and storage, Account head of stores - operation, records and returns; disposal of released and surplus stores - return to stores Depot, disposal by auction; verification of stock and adjustment for shortage/excesses.</p> <p>4. Law and Order Railway Police; lodging complaints; cooperation with railway police; cognizable offences; non cognizable offences; powers of arrest of railway staff; warrant against railway staff; action by railway staff in case of attempted sabotage; answering of court summons; Prevention of trespass disposal of human bodies found run over; disposal of cattle found dead on the line.</p>	
18	Track Machines:	4%
	<p>a) Provisions of Indian Railway Track Machines Manual.</p> <p>b) Working principles and performance parameter of various Track Machines on Indian Railways.</p> <p>c) Controls and working systems of various Track Machines.</p> <p>d) Working of various Track Machines: Pre- requisites, pre- block preparatory works and Operations during block, post-block attention works.</p> <p>e) Working of tamping machines in design mode.</p> <p>f) Performance and quality parameters in tamping, squeezing pressure, squeezing time, vibration pressure and tamping depth.</p> <p>g) Maintenances schedules of various track machines.</p> <p>h) Troubleshooting.</p> <p>i) Rules for movement and working of track machines.</p> <p>j) Types of small track machines required for maintenance of track and their maintenance systems.</p>	
19	Official Language policy (Optional as per Para 204.3 of IREM Vol.I)	10 %
	ii. Establishment and Financial Rules	
20	Establishment and Financial Rules	30%
	Total	100%

19