

## RECRUITMENT /VACANCY NOTICE

- (1) The Andaman Public Works Department (A.P.W.D), Andaman & Nicobar Administration invite ONLINE application from eligible candidates to fill-up the following Group ‘ B’(Non-Gazetted) Non-Ministerial posts in the Pay Matrix Level as indicated against each under Andaman Public Works Department (A.P.W.D), Andaman & Nicobar Administration. The selection will be done by holding a **“Written Professional Examination/Test”** by A & N Administration.

Sl. No	Name of Post	Group	Pay Matrix Level as per 7 <sup>th</sup> CPC
1.	Junior Engineer (Civil)	Gr. ‘ B’(NG)	Level -6 (PB-2 Rs.9300-34000 + GP Rs.4200 as per 6 <sup>th</sup> CPC)
2.	Junior Engineer (Electrical & Mechanical)	Gr. ‘ B’(NG)	Level -6 (PB-2 Rs.9300-34000 + GP Rs.4200 as per 6 <sup>th</sup> CPC)

- (2) **Category Wise Details of Vacancies:-**

Sl. No.	Name of Posts	Category Wise Details of Vacancies				Total
		UR	OBC	ST	PwD (OH/VH/HH)	
1.	Junior Engineer (C)	12	7	01	0	20
2.	Junior Engineer (E&M)	05	03	0	0	08

### **How to apply:-**

- The ONLINE application can be submitted at [www.and.nic.in](http://www.and.nic.in) **from 01.01.2019 at 11:00 AM to 31.01.2019 on 05:00 PM.**
- The other details are available in the Website-[www.and.nic.in](http://www.and.nic.in)

Engineer Officer  
To Chief Engineer  
Chief Engineer’s Office  
APWD, Port Blair  
Ph: 03192-238776  
03192-239310

## भर्ती / रिक्ति सूचना

अण्डमान तथा निकोबार प्रशासन के अंतर्गत अण्डमान लोक निर्माण विभाग में वर्ग-“ख” “अराजपत्रित” “अमंत्रालयी” निम्नलिखित पदों की आगे दर्शायी गई पे-मैट्रिक्स स्तर के अनुसार पात्र उम्मीदवारों से ऑन-लाईन आवेदन आमंत्रित करते हैं। इसका चयन अण्डमान तथा निकोबार प्रशासन द्वारा “लिखित व्यवसायिक परीक्षा” द्वारा किया जाएगा।

क्र.सं.	पद का नाम	वर्ग	7वें वेतन आयोग के अनुसार पे-मैट्रिक्स स्तर
1.	कनिष्ठ अभियंता (सिविल)	वर्ग-“ख” “अ.रा.”	लेवल-6 (पी.बी.-2 9300-34800 ग्रेड वेतन रु.4200/- छठे वेतन आयोग के अनुसार)
2.	कनिष्ठ अभियंता (विद्युत एवं यांत्रिकी)	वर्ग-“ख” “अ.रा.”	लेवल-6 (पी.बी.-2 9300-34800 ग्रेड वेतन रु.4200/- छठे वेतन आयोग के अनुसार)

### श्रेणी वार रिक्तियों का विवरण :

क्र.सं.	पद का नाम	श्रेणीवार रिक्तियों का विवरण				कुल
		अनारक्षित	अ.पि.जा.	अ.ज.जा.	दिव्यांग (ओ.एच. / वी.एच. / एच. एच.)	
1.	कनिष्ठ अभियंता (सिविल)	12	7	01	0	20
2.	कनिष्ठ अभियंता (विद्युत एवं यांत्रिकी)	05	03	0	0	08

### कैसे आवेदन करें :

- वेबसाइट [www.and.nic.in](http://www.and.nic.in) में दिनांक 01.01.2019 के 11.00 बजे से 31.01.2019 को शाम 5.00 बजे तक ऑनलाईन आवेदन कर सकते हैं।
- अन्य विवरण वेबसाइट [www.and.nic.in](http://www.and.nic.in) पर उपलब्ध है।

मुख्य अभियंता के अभियंता अधिकारी  
मुख्य अभियंता कार्यालय  
अण्डमान लोक निर्माण विभाग  
पोर्ट ब्लेयर  
दूरभाष सं. 03192-238776  
03192-239310

## **RECRUITMENT /VACANCY NOTICE**

### **RECRUITMENT EXAMINATION TO THE POSTS OF JUNIOR ENGINEER (CIVIL) AND JUNIOR ENGINEER (ELECTRICAL & MECHANICAL) UNDER ANDAMAN PUBLIC WORKS DEPARTMENT (A.P.W.D), ANDAMAN & NICOBAR ADMINISTRATION**

- (1) The Andaman Public Works Department (A.P.W.D), Andaman & Nicobar Administration invite ONLINE application from eligible candidates to fill-up the following Group ' B'(Non-Gazetted) Non-Ministerial posts in the Pay Matrix Level as indicated against each under Andaman Public Works Department (A.P.W.D), Andaman & Nicobar Administration. The selection will be done by holding a **“Written Professional Examination/Test”** by A & N Administration.

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2.	Junior Engineer (Electrical & Mechanical)	Gr. ' B'(NG)	Level -6 (PB-2 Rs.9300-34000 + GP Rs.4200 as per 6 <sup>th</sup> CPC)

The candidates who have registered their candidature in the Employment Exchanges must also submit ONLINE application irrespective of their name being sponsored by the Employment Exchanges or otherwise.

(2) **Category Wise Details of Vacancies:-**

Sl. No.	Name of Posts	Category Wise Details of Vacancies				Total
		UR	OBC	ST	PwD (OH/VH/HH)	
1.	Junior Engineer (C)	12	7	01	0	20
2.	Junior Engineer (E&M)	05	03	0	0	08

Note-1. Brief of abbreviation used above:- UR-Un-Reserved, OBC- Other Backward Classes, ST-Schedule Tribes, PwD- Persons with Disability, OH-Orthopedically Handicapped, VH-Visually Handicapped, HH- Hearing Hampered.

Note-2. The numbers of vacancies may change and any change will be published in the website.

### **3. Eligibility Conditions:-**

(a) **Nationality:-** Applicant must be an Indian National.

(b) **Age Limit:-**

Junior Engineer(C) and Junior Engineer (E&M)	18-30 Years for male candidates 18-35 Years for Female candidates [Age relaxable for Govt. servant, ST & OBC Candidates in accordance with the instruction of order issued by the Central Government from time to time].
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**Note:** The crucial date of determining the age limit shall be **31.01.2019**

(c) **Post Wise Essential Qualifications:-**

Sl.No.	Name of Post	Essential Qualification
1.	Junior Engineer (Civil)	<b>Essential:</b> I. Degree or Diploma in Civil Engineering from a recognized University/Board/Institution or having passed Part A & B examination of Institution of Engineers (India). II. Should qualify in the written professional test to be conducted by the Administration or any authorized

		Recruitment Agency for direct Recruitment.
2.	Junior Engineer (Elec. &Mech.)	<p><b>Essential:</b></p> <p>I. Degree or Diploma in Electrical or Mechanical Engineering or Automobile Engineering or Electrical &amp; Electronics or Air Conditioner/Refrigerator Engineering from a recognized University/Board/ Institution or having passed Part A &amp; B examination of Institution of Engineers (India).</p> <p>II. Should qualify in the written professional test to be conducted by the Administration or any authorized Recruitment Agency for direct Recruitment.</p>

**Note:** Qualification acquired through distance education mode at Diploma and Bachelor Level in the fields of Engineering & Technology is not eligible.

(4) **Fee Payable:** -

**No Fee.**

(5) **Center of Examination:** - The Written Professional Test/Examination will be held only at Port Blair in one or more centers.

(6) **Method of Selection:** - **By written examination**

(7) **Written Examination:-**

- Objective-Multiple- Choice-Type” Question.
- The question paper will be set in English only.
- The scheme of the examination, the time allowed and the maximum marks for each Post will be as follows:-

**I. For the post of Junior Engineer (Civil)**

SCHEME OF WRITTEN EXAMINATION	NO. OF QUESTION	TOTAL MARKS	DURATION	Marking Scheme		
				Correct option	Wrong option	Not attempted
Objective multiple choice type paper in the concerned subject	100	200	2 Hours	02	(-) 0.50 (minus 0.50)	0

**Syllabus for the Written Professional Examination for the post JE (C):** - The detail syllabus of the Written Professional Examination for the post of Junior Engineer (Civil) is appended under Annexure- A.

**II. For the post of Junior Engineer (Electrical & Mechanical)**

SCHEME OF WRITTEN EXAMINATION	NO. OF QUESTION	TOTAL MARKS	DURATION	Marking Scheme		
				Correct option	Wrong option	Not attempted
Objective multiple choice type paper in the concerned subject	100	200	2 Hours	02	(-) 0.50 (minus 0.50)	0

**Syllabus for the Written Professional Examination for the post of JE (E&M):** - The detail syllabus of the Written Professional Examination for the post of Junior Engineer (Electrical & Mechanical) is appended under Annexure- B.

**NOTE:-**Examination Centre, Date and time of Examination will be informed later along-with the Hall Ticket.

**(8). How to apply: -**

- a) The ONLINE application can be submitted at [www.and.nic.in](http://www.and.nic.in) **from 01.01.2019 at 11:00 AM to 31.01.2019 on 05:00 PM.**
- b) Online application consists of five sections viz. (1) Personal details, (2) Posts & Examination center details, (3) Qualification details, (4) Additional details and (5) upload Photograph and Signature.
- c) Only those application which are complete with all the above five section will be treated as complete. However, applications that are submitted partially, due to reasons such as network issues, can be resumed and completed at later point of time through appropriate options in the recruitment portal. All such applications are to be completed before the last date of online application.
- d) Candidates have to upload good quality Photograph and Signature in jpeg format. If the uploaded photograph is not legible and of poor quality then your admission to the examination hall may be prohibited.
- \* Photograph should be between 10 kb to 50 kb and the resolution recommended is 200x230 (width x height) in jpeg format and  
\* Signature should be between 10 kb to 20 kb and the resolution is 140x60 (width x height) in jpeg format.
- e) The printout of the ONLINE e-application along-with self-attested copies of (i) Proof of age, (ii) Educational Qualification, (iii) Category (Scheduled Tribe Certificate in respect of Scheduled Tribe candidates and OBC Certificate in respect of OBC candidates), (iv) Proof of Identity (A copy of any other Identity Card issued by Government Agency) (v) All relevant supporting documents for claiming age relaxation if any need to be **sent to the Engineer Officer to Chief Engineer, Chief Engineer's Office, APWD, Nirman Bhawan, Port Blair, Pin-744101 latest by 15.02.2019 upto 05.00 PM** either in person or by post.
- f) The printout of e-application along-with required documents received after the due date will not be accepted and the department will not be responsible for postal delay.

**The scrutiny of hard copy of e-application will be done and the list of eligible and Non-eligible will be published in the website [www.and.nic.in](http://www.and.nic.in) on 28.02.2019**

**INSTRUCTIONS AND CONDITIONS:-**

1. Only self-attested copy of certificates to be enclosed along-with the printout of the ONLINE e-application form. **Original certificate should not be attached** with the application.
2. The ONLINE e-application form is available on the website [www.and.nic.in](http://www.and.nic.in) and all the field of e-application form are mandatory to be filled by the candidate failing which the e-application form cannot be uploaded to the generator. The printout of e-application (duly submit only) must be attached the required self-attested copies of certificate failing which the candidature shall be rejected. No further correspondence will be entertained in this regard.
3. Candidates are advised to fill the ONLINE application carefully with due diligence as once application is submitted cannot be modified.

4. Request for change/correction, in any particulars in the application form, once submitted will not be entertained under any circumstances. The Department will not be responsible for any consequence arising of non-acceptance of correction/addition/deletion in any particular filled in the online application form whatever the reasons may be.
5. On successful submission of online application a unique Application number will be provide to the candidate and website will also allow the applicant to take print-out of the application so submitted. Candidates must note down this application number for further reference and for retrieval/reprint of application form.
6. Those, who may fail to take print-out immediately after submitting their application can also download the filled in application forms later also with the help of unique Application number but before the last date of online application.
7. The nature of vacancy is temporary, but likely to continue with 02 year probation period subject to further extension at the discretion of competent authority.
8. Only Scheduled Tribe candidates notified for A&N Islands are eligible to apply for the reservation against Schedule Tribe (ST) quota. The other ST candidate will be considered only for Unreserved Vacancies.
9. Similarly, Other Backward Class covered under the category of "OBC" as specified in the Gazette Notification of A&N Administration are eligible to apply for the reservation against Other Backward Class (OBC) quota only.
11. Before submitting his/her ONLINE e-application form the candidate must carefully read the eligibility conditions for the examination and satisfy himself/herself that he/she fulfills all eligibility conditions. In case of false submission, legal action will be initiated.
12. Admission Card/Hall ticket for the Written Examination indicating the Time Table, venue etc. of Examination should have to be downloaded from the website [www.and.nic.in](http://www.and.nic.in) and no Admission Card/Hall ticket will be sent by post.
13. The candidates are advised to visit the website for latest updates of the recruitment process regularly.
14. The Chief Engineer, APWD reserves the right to accept/reject any application without assigning any reason thereof.
15. In case of any difficulties in filling the online application the candidates may contact on Phone 238776 and 230215. They can also send there grievances to [email-ceapwd@and.nic.in](mailto:email-ceapwd@and.nic.in).

Engineer Officer  
To Chief Engineer  
Chief Engineer's Office  
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**Syllabus for recruitment of Junior Engineer (Civil):-**

1. **Building Materials:** Physical and chemical properties, classification, standard tests, uses and manufacture/quarrying of materials e.g. building stones, silicate based materials, cement (Portland), Asbestos products. Timber and Wood based Products, laminates, bituminous materials, paints, varnishes.
2. **Concrete Technology:** Properties, Advantages and uses of concrete, cement aggregates, importance of water quality, water cement ratio, workability, mix design, storage, batching, mixing, placements, compaction, finishing and curing of concrete, quality control, hot weather and cold weather concreting, repair and maintenance of concrete structure, Admixture and additives.
3. **Surveying:** Principles of surveying, working of prismatic, compass and bearings, planetable surveying, theodolite traverse, adjustment of theodolite, leveling and contouring, curvature, refraction correction, permanent adjustment of dumpy level, methods of contouring and uses of a contourmap, tacheometric survey, Curves, Horizontal and Vertical Curves.
4. **Soil Mechanics:** Origin of soil phase diagram, definitions of void ratio porosity, degree of saturation, water content specific gravity of soil grains and unit weights, grain size distribution curves for different soil and their uses, Atterberg's limits, ISI soil classification, plasticity chart, coefficient of permeability, effective stress, consolidation of soils. Classification, shear strength of soils, direct shear test, vane shear test, triaxial test, soil compaction, Lab compaction, Lab compaction test, moisture content and bearing capacity of soil, plate load test standard penetration test.
5. **Theory of Structures:** Elasticity constants, Types of beams, determinate and indeterminate, Bending moment and shear force diagrams of simply supported, cantilever and over hanging beams, Moment of area and moments of inertia for rect. & circular section, bending moments of shear stress for tee, channel and compound sections, chimneys, dams and retaining walls, eccentric loads slope deflection of simply supported and cantilever beams, critical load columns, torsion of circular section.
6. **RCC & Steel Design:** RCC beams, flexural strength, shear strength, bond strength, design of single reinforce beams, lintels, cantilever beams, double reinforced beams, one way slabs two way slabs, reinforced brick work, T-beams, columns, staircases, retaining walls, water tanks steel design, welded connections, riveted joints, design and construction of steel columns, beams roof trusses plate girders.
7. **Hydraulics:** Fluid properties, hydrostatics, measurements of flow, Bernoulli's theorem and its application, flow through pipes, flow in open channels, weirs, flumes spillways, pump and turbines.
8. **Public Health Engineering:** Quality of water, source of water supply, purification of water, distribution of water, need of sanitation, sewerage

systems, circular sewers oval sewers, sewer appurtenances surface water drainage, sewage treatments.

9. **Transport and Highway Engineering:** Classification of Highway, Structural and geometrical components, Design of various elements of highway, Junction and intersection, Type of curves, Elements of curves, Setting out of curves, Materials for highway their testing and types, Physical, Chemical and Mechanical properties, Classification of traffic, Traffic survey, Important characteristics and Highway Construction.
10. **Port- Harbour and Airport:** Definitions and Classifications, Important Components and their Characteristics, Site Investigation and Requirement, Navigation and Control, Essential Amenities and Requirement.

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Engineer Officer  
To Chief Engineer  
Chief Engineer's Office  
APWD, Port Blair



**SYLLABUS FOR RECRUITMENT OF JUNIOR ENGINEER (E&M)**

- 1. Basic Electrical Engineering & Electrical Measurements:** Concept of currents, voltage, resistance, power & energy, their units, ohm's law, electrical symbols.
- 2. Circuit Laws:** Kirchhoff's law, solution of simple network problems, network theorems and their applications, concept of flux, EMF, reluctance, Electro-magnetic induction, self and mutual inductance, A.C fundamental, instantaneous, simple series and parallel A.C circuits consisting of R.L. and C, Measurement and measuring instruments, Analog & Digital ammeters and voltmeters, Extension of range, Wattmeter, Multimeters, Megger, Low Voltage transformers CT & PT.
- 3. Electrical Machines:** Basic principles of AC & D.C. Motors & Generators, their characteristics, speed control & Starting of AC & D.C. Motors, losses & efficiency of AC & D.C. Machines, principles of operation, equivalent circuit, voltage regulation, O.C and SC tests, efficiency, auto transformers, Generation of three phase EMF, 3-Phase induction motor, rotating magnetic field. Principle of operation, equivalent circuit, torque speed characteristics, starting and speed control of 3 phase induction motor, fractional KW motors, 1- Phase induction motor, types of AC Motors, DG Sets, operation.
- 4. Estimation and costing:** Details of illumination system, details of load distribution, Design of electrical installation & its symbols (internal & external), Energy efficient equipment, energy audit, protection systems of Electrical circuit, Earthing Systems, Testing of Electrical Installations, types of cables –Overhead & underground.
- 5. General Distribution:** Types of faults, short circuit current for symmetrical faults, Protection & Switchgear-rating of circuit breakers, principles of arc extinction by oil and air, H.R.C fuses, Protection earth leakage, Bus Bar arrangement.
- 6. Lightning Arrestors:** Distribution systems, Comparison of conductor materials efficiency of different systems, utilization of electrical energy, illumination, electric heating, electric welding, electroplating, electric drivers etc.
- 7. Renewable Energy: Solar Energy – Direct Uses,** State the concept of solar radiation, Describe the working principle of solar thermal systems, Compare different solar photovoltaic system, Solar Radiation, Sun & Earth, Solar Spectrum, Sun & Earth Movement, Solar Geometry: Concept, Solar Thermal Applications & Its working Principles, Water Heating, Space Heating, Space Cooling and Refrigeration, Power Generation, Distillation. Solar Photovoltaic Conversions: Principle of working of Solar cell, Construction Details containing capacity, size & materials of Solar

Photovoltaic System Applications- Solar Lantern, Solar Home System, SPV Street Light, SPV Traffic Signal, Info -display, SPV Power Pack, Stand alone SPV Power Plant, Solar Generators, Building Integrated PV Systems, SPV Pumping Systems (No derivations & numericals).

- 8. Introduction to Refrigeration:** Define various terms related to refrigeration, Explain various refrigeration cycles, Explain properties and environmental effects of refrigerants. Definition, Necessity of refrigeration, Concept of heat engine, heat pump and Refrigerator, Unit of refrigeration, C.O.P., EER and refrigerating effect, Non conventional methods of refrigeration like Vortex tube, Pulse tube refrigeration, solar refrigeration. Refrigerants: Classification, Desirable Properties, selection & Nomenclature of refrigerants. Concept of Green House Effect, Ozone Depletion, Global warming. Concept of Ozone Depletion Potential (ODP) & Global Warming Potential (GWP) of different Refrigerants. Eco-friendly refrigerants like R-134a, Hydrocarbon refrigerants. Refrigeration Cycles, Reversed Carnot Cycle and its representation on PV and TS diagram. Air Refrigeration Cycles - Bell Coleman air refrigerator. Representation on PV and TS diagram, Types and applications like aircraft refrigeration using simple air cooling system.
- 9. Air Conditioning & Air Distribution Systems:** Identify various air conditioning systems, Classification of systems: Industrial and commercial Air Conditioning Systems- Window type, split type, central type AC & its plant, Air distribution systems. Duct systems: Closed perimeter system, extended plenum system, Radial duct system, duct materials, requirement of duct materials, losses in ducts, Fans and Blowers- Types, working of fans and blowers , Air distribution outlets, Supply outlets, return outlets, grills, and types of diffusers, Insulation: Purpose, properties of insulating material, Types of insulating materials, Methods of applying insulation, maintenance of AC plants.
- 10. Applications of Refrigeration and Air Conditioning Systems:** Explain various Refrigeration and Air Conditioning systems. Applications of refrigeration and air conditioning in following areas: Domestic Applications, Commercial Applications, Industrial Applications, Automobile Air conditioning systems, Ice plant & cold storage.
- 11. Battery:** Automotive battery construction and operation, battery capacity, Battery ratings, Battery tests Charging System : Need of charging system, Construction and operation of charging system, Alternator principle, construction and working, Starting System, Lighting System, Ignition System and their Components.
- 12. Basic Electronics:** Electronics- Atomic structure of elements. The electron Energy of an electron valence electrons – Free electrons -Voltage source - Constant voltage source - Constant current source.

- 13. Electron Emission:** Electron emission, types of electron emission-Thermion emission – Thermionic emitter.
- 14. Transistors:** Transistor-Transistor action-Transistor symbols-Transistor as an amplifier.
- 15. Regulated D.C. Power Supply:** Ordinary D.C. Power supply, Regulated power supply. Types of voltage regulators - Zener diode voltage regulator.
- 16. Electronic Instruments:** Electronic instruments, Multi-meters, Applications of multi-meter sensitivity of multi-meter merits & demerits of multi-meter. Meter protection Vacuum tube voltmeter-applications of VTVM-merits and demerits of VTVM.
- 17. Semi Conductor Physics:** Semi conductor Bonds in semiconductor-commonly use semiconductors, energy band description of semiconductors-effect of temperature on semiconductor-intrinsic semiconductor-extrinsic semiconductor-properties of pn junction.
- 18. Semi Conductor Diode:** Semi conductor diode, logic gates, Half wave rectifier-full wave rectifier, zener diode, special diodes, optical diodes, Filters-LC filter,  $\pi$  filter.
- 19. Solid State Switching Circuits:** Switching Circuit-Mechanical Switch Electronic Switch Advantages of Electronic Switches-Switching action of a transistor.
- 20. Working Principle, Advantage & Application of field effect transistors.**
- 21. Working Principle, Advantage & Application of Silicon Controlled Rectifier (SCR).**
- 22. Working Principle, Advantages & Applications of Triac.**
- 23. Working Principle, Advantages & Application of Uni-junction Transistor(UJT).**
- 24. Computer & its applications- Basics of hardware and Software.**
- 25. Flow of Fluids:** Measurement of discharge: flow through pipes friction losses. Forces of jet impinging on vanes, blades, work done and efficiency, classification of pumps.
- 26. Production Engineering:** Foundry-different casting processes, concept of patterns, types of mold making, pouring defect in castings, causes & remedies, welding – classification and types of welding, Testing & defects in welds, Lathes-working of lathes: various tools, operation on lathes, types of lathes, drilling operations performed on drilling machines. Description, Principles of working and various



- 34. I.C. Engine Testing and Pollution Control:** IC Engine Testing - I.P., B.P. Mechanical, Thermal etc., List of fuel, lubricant additives and their advantages. Pollution Control Pollutants in exhaust gases of petrol and diesel engines, their effects on environment, exhaust gas analysis for petrol and diesel engine, Catalytic Converter, Bharat stage III, IV norms.
- 35. Air Compressor:** Explain the concept of single and multistage compressor. List the methods of energy saving. Introduction Uses of compressed air, Classification of air compressors, Definitions of Pressure ratio, Compressor capacity, Free Air Delivered, Swept volume. Reciprocating Air Compressor, Rotary Compressor.
- 36. Corrosion:** Definition of corrosion, Types of corrosion. Atmospheric Corrosion: Definition, mechanism of oxidation corrosion, types of oxide films and their significance, factors affecting rate of atmospheric corrosion. Immersed Corrosion: Definition, mechanism of immersed corrosion by galvanic cell action- with evolution of hydrogen gas and absorption of oxygen gas, factors affecting immersed corrosion.
- 37. Protection of metals by:** Modification of properties of metal, electrochemical protection by sacrificial anodic protection and impressed current cathodic protection, use of protective coatings. Application of metallic coatings: By galvanising, tinning, metal spraying, electroplating, metal cladding, cementation- sherardizing, chromising, colourising. Application of non-metallic coatings: paint-definition, characteristics, constituents of paint and their functions.
- 38. Fuels:** Properties of fuels: Definition of a fuel, calorific value and ignition temperature. Characteristics of a good fuel, Classification of fuels with suitable examples, advantages and disadvantages of solid fuels, liquid fuels and gaseous fuels. Classification of fuels: Solid fuels: Analysis of solid fuel - proximate analysis for determination of moisture, volatile matter, ash and fixed carbon, significance of proximate analysis, determination of gross calorific value by using Bomb calorimeter. Liquid fuels: Origin, fractional distillation of crude petroleum, boiling range, composition, and applications of petroleum fractions obtained, composition, properties, applications of-Biodiesel. Gaseous fuels: Composition, properties, applications of- Biogas, LPG, CNG.
- 39. Lubricant:** Definition of lubricant, functions of lubricants. Classification of lubricant, & method of Application. Selection of Lubricants for road rollers, sewing machine, concrete mixer, I.C engine, cutting tools, gears.
- 40. Simple Machines:** Find Efficiency of given machine, Definitions of Simple machine, compound machine , load , effort , mechanical advantage, velocity ratio , input of a machine ,output of a machine efficiency of a machine , ideal machine, ideal effort and ideal load, load lost in friction, effort lost in friction.

- 41. Industrial Safety and Legislative Acts:** Safety Management, Causes of accidents, Types of Industrial Accidents, Preventive measures, Safety procedures, Industrial Legislation - Necessity of Acts, Important Definitions & Main Provisions of following acts: Indian Factory Act, Workman Compensation Act, Minimum Wages Act. Inventory Concept, its classification, functions of inventory, ABC Analysis - Necessity & Steps, Economic Order Quantity Concept, graphical representation, determination of EOQ, Standard steps in Purchasing, Modern Techniques of Material Management. Material Resource Planning (MRP) - Functions of MRP, Input to MRP, Benefits of MRP. Enterprise Resource Planning (ERP) - Concept, list of modules, advantages & disadvantages of ERP.
- 42. Materials Management:** Inventory Concept, its classification, functions of inventory, Standard steps in Purchasing, Modern Techniques of Material Management- Material Resource Planning (MRP) - Functions of MRP, Input to MRP, Benefits of MRP, Enterprise Resource Planning (ERP) - Concept, list of modules, advantages & disadvantages of ERP
- 43. Quality Management:** Meaning of Quality, Quality Management System - Activities, Benefits, Quality Control - Objectives, Functions, Advantages, Quality Circle - Concept, Characteristics & Objectives, Quality Assurance – Concept, Quality Assurance System, Meaning of Total Quality and TQM, Components of TQM – Concept, Elements of TQM, Benefits, Modern Technique & Systems of Quality Management like Kaizen, 5'S', 6 Sigma, ISO 9001:2000 - Benefits, Main clauses.
- 44. Basics of Oil Hydraulic System:** Identify various components in simple oil hydraulic circuits. List the types of various components in simple oil hydraulic circuits. Explain the construction and working principle of various components in simple oil hydraulic circuits. Contents, General layout, Applications, Merits and limitations of oil hydraulic systems, Overview of essential properties of oils used in oil hydraulic circuits, Construction, working principle, applications and symbols of Vane pump, gear pump, Gerotor pump, screw pump, piston Pump.
- 45. Basic Design Considerations:** Design philosophy and Procedures, General Considerations in Design, Types of loads, concepts of stress ,strain, Stress – Strain Diagram for, Ductile and Brittle Materials, Types of Stresses such as Tension, Compression, Shear, Bearing pressure, Intensity, crushing, bending and torsion, Principle Stresses (Simple Numericals), Concept of Creep, Fatigue, S-N curve, Endurance Limit.
- Properties of Engineering materials:** Designation of materials as per IS and introduction to International standards, advantages of standardization, use of design data book, use of standards in design and preferred numbers series. Distortion energy theory.

**Modern Design considerations:** Design for safety, Ecology, societal consideration & Concept of Product Design, System Design & Creativity in Design, Ergonomics and aesthetic considerations in design.

Engineer Officer  
To Chief Engineer  
Chief Engineer's Office  
APWD, Port Blair