

INDEX

SNo	<i>Description</i>	Page No
01	Guidelines for Departmental Qualifying Examination	3-7
02	<i>Scheme of Constitution</i>	8
03	Section A - Common Syllabus for all trades of Supervisors	9-11
04	Section B- Syllabus for Trade Testing Examination of :-	
	<u>Engineering</u>	
	Part A – Common Syllabus for all Engineering Trades	12-13
	(a) Machinist	14-15
	(b) Pattern Maker	16
	© Foundry	17-18
	(d) Engine Fitter	19
	(e) Machinery Control Fitter	20-21
	(f) Refrigeration and Air Conditioning	22-26
	(g) ICE / GT	27-29
	(h) Boiler Maker/Insulation	30-31
	(j) Pipe Fitter	32-33
	<u>Electrical</u>	
	Part A – Common Syllabus for Power Trade	34-35
	(a) Power	36-40
	<u>Weapons</u>	
	Part A – Common Syllabus for all Weapon Trades	41-42
	(a) Weapon	43-45
	<u>Common syllabus for electronics based trades</u>	46-58
	(b) Radio/Radar	59-74
	(c) Fire Control Computer	75-77
	(d) Sonar and Controls	78-79
	(e) Instruments	80-88
	(f) Gyro	89-93

	<u>Construction</u>	
	Part A – Common Syllabus for all Construction Trades	94-95
	(a) . Plater	99-102
	(b) Ship Fitter	103-106
	(c) Welder	107-112
	(d) Painter	113 -122
	(e) Shipwright	123-129
	(f) Tailor	130-134
	(g) Rigger	135-140
	<u>Maintenance</u>	
	Part A – Common Syllabus for all Maintenance Trades	141-142
	(a) Millwright	143-145
	(b) Civil Maintenance	146
	(d) Crane Fitter (ICE)	147-149
	(e) PPC*	150
05	Section C - Soft Skill syllabus for Foreman in addition to trade syllabus	151-153

GUIDE LINES FOR DEPARTMENTAL QUALIFYING EXAMINATION OF TECHNICAL SUPERVISORS

Background

1. NO(Civ) 7/78 lays down the syllabi and rules for conduct of examination for Supervisory Staff in Dockyards and Naval Ship Repair Yards of Indian Navy. This Navy Order needs to be revised from three tier to adapt to four tier structures for Technical Supervisory Staff implemented recently.

2. **Job Specification.** The job specification of the four tier of Technical Supervisors be defined as follows:-

(a) **Chargeman II.**

(i) The candidate should have deep technical knowledge of his trade and adequate awareness of the technology of which his trade is a subset. He should be adequately aware of the latest developments in technology concerning his trade so as to adapt to the changes as and when they are introduced. He should be able to handle all jobs of his trade himself as well as guide his sub-ordinates.

(ii) He should have elementary knowledge of administrative procedures, organisational rules, production methods, facilities, safety and first aid regulations, production, planning and control procedures, quality control aspects, demanding and accounting of stores etc. He should be computer literate and be able to adapt to the IT based applications as relevant.

(b) **Chargeman I.**

(i) The candidate should have deep technical knowledge of this trade and awareness of the technology of which his trade is a subset. He should be sufficiently aware of the latest developments in technology concerning his trade so as to adapt to the changes as and when they are introduced. He should be able to handle all jobs of his trade himself as well as guide his sub-ordinates.

(ii) He should have working knowledge of administrative procedures, organizational rules, production methods, facilities, safety and first aid regulations, production, planning and control procedures, quality control aspects, demanding and accounting of stores etc. He should be computer literate and be able to adapt to the IT based applications as relevant.

(b) **Asstt. Foreman.**

(i) The candidate should have good technical knowledge of this trade and good awareness of the technology of which his trade is a subset. He should be well aware of the latest developments in technology concerning his trade so as to adapt to the changes as and when they are introduced. He should be able to guide his sub-ordinates in technically challenging jobs.

(ii) He should have good knowledge of administrative procedures, organizational rules, production methods, facilities, safety and first aid regulations, production planning and control procedures, quality control aspects, demanding and accounting of stores etc., He should be computer literate and able to adapt to the IT based applications as relevant. He should be able to lead his sub-ordinates in implementing changes brought in by IT applications.

(c) **Foreman.**

(i) The candidate should have good technical knowledge of his trade and very good awareness of the technology of which his trade is a subset. He should be very well aware of the latest developments in technology concerning his trade so as to adapt to the changes as and when they are introduced. He should be able to guide his sub-ordinates in technically challenging jobs.

(ii) He should have good knowledge of administrative procedures, organizational rules, production methods, facilities, safety and first aid regulations, production planning and control procedures, quality control aspects, demanding and accounting of stores etc., He should be computer literate and able to adapt to the IT based applications relevant to his day to day job.

Formation of Examination Board.

(a) **For Foreman and Asstt. Foreman.** The boards of examination will consist of three technical officers. The board will be appointed by the Admiral/Commodore/Captain Superintendent of the Dockyard or Flag Officer Commanding-in-Chief/Naval Officer in-charge.

(b) **For Chargeman I&II.** The boards of examination will consist of three technical officers. The board will be appointed by the Admiral/Commodore/Captain Superintendent of the Dockyard or Flag

Officer Commanding-in-Chief/Naval Officer in-charge. The President of the board will ensure attendance of Department Labour officer as an observer.

5. **Eligibility**

(a) **For Foreman.** Asstt. Foreman can appear for examination to the higher grade after they have completed one year service in the existing grade.

(b) **For Asstt. Foreman.** Chargeman Grade-I can appear for examination to the higher grade after they have completed the period of probation in the existing grade.

(c) **For Chargeman I.** Chargeman Grade-II can appear for the examination after completing one year service in existing grade. In case of direct recruits, on completion of probationary period.

(d) **For Chargeman Grade II.** Tradesman Highly Skilled can appear for the examination after they have completed one year service in the existing grade.

6. **Qualifying Percentage.** The qualifying marks will be 50% marks for all grades. In the case of Foreman and Asstt. Foreman, it will be mandatory to qualify separately in written as well as oral examinations with minimum of 50% marks in each.

7. **Chances.** There will be no restriction on the number of times unqualified candidate can appear for the examination.

8. **Results.** The results of the examination i.e. whether qualified or not, will be communicated to the candidates.

9. **Absence on Date of Examination.** Candidates remaining absent on the dates of examination will have to apply again, for the next examination. On no account will they be examined by the same examination board on a subsequent date.

10. **Panels**

(a) **Foreman and Asstt. Foreman.** The panels for promotions to the foreman and Asstt. Foreman will be drawn by the local Departmental promotion Committee in the Naval Dockyard/Command and will normally be valid for period of one year unless extended for a further period. The inclusion of a individual's name in a panel does not mean that he will be automatically promoted during the currency of the

panel. Promotion will depend upon the availability of vacancies and the necessity to fill them.

(b) The panel for promotion will be drawn up by the local departmental promotion committee in the Naval Dockyard/Ship Repair Yard/command and will normally be valid for one year unless otherwise extended. The inclusion of an individual's name in the panel does not mean that he will be automatically promoted. Promotion will depend upon the number of vacancies and record of service of the individual.

11. **Syllabus.** Detailed syllabus for trades is given in section A, B and C.

12. **Malpractices.** Any malpractices during the examination may entail the candidate to be debarred from appearing for the departmental examination for a period of 03 years or less, apart from any disciplinary action that may be called for.

13. **Examination.**

(a) **Foreman and Asst Foreman.** Departmental examination to be held once a year. This will be a qualifying exam and not a competitive exam. Examination to consist of the following parts:-

(i)	Part A -	Administrative Knowledge	- 25 marks
(ii)	Part B -	Professional Knowledge (Written)	- 25 marks
(iii)	Part C -	Oral	- 50 marks -----
		Total	100 marks

(b) **For Chargeman I & II.** Departmental examination to be held once a year. This will be a qualifying exam and not a competitive exam. Examination to consist of the following parts:-

(i)	Part A -	Administrative Knowledge (written)	- 15 marks
(ii)	Part B -	Professional Knowledge (Written)	- 35 marks
(iii)	Part C -	Oral	- 40 marks

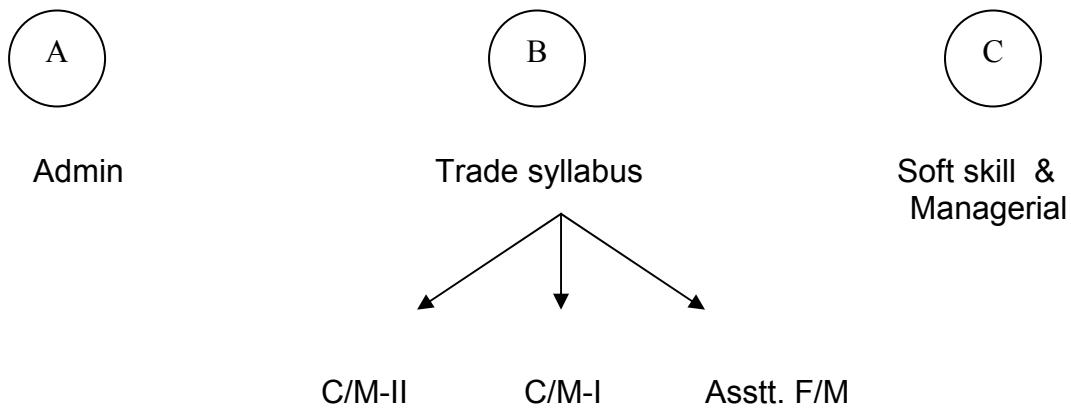
(iv)	Part D -	Departmental Assessment	- 10 marks -----
		Total	100 marks

SCHEME OF CONSTITUTION OF SUPERVISORY TRADE SYLLABUS

1. The four tier Supervisory trade DQE Syllabus comprises of three major types of subject groups vis. Administration, Technical and Softskill & Managerial. The scheme of constitution of syllabus for each Supervisory cadre is explained below: -

2. GROUPS OF SYLLABI

Section A – Administration
Section B - Trade wise Syllabus
Section C– Soft skill & Managerial



3. CONSTITUTION

<u>SNo</u>	<u>Designation</u>	<u>Syllabus</u>
(a)	C/MAN –II	A + (B C/M-II)
(b)	C/MAN –I	A + (B C/M-I)
(c)	ASST. FOREMAN	A + (B Asst. F/M)
(d)	FOREMAN	A + (B Asst. F/M) +C

SECTION – A

Sl. No.	Common Syllabus for all trades (on General Administration, Safety, Training, Production & Planning, Quality Circle & Control, ISO 9002/14001, TQM, PPM & TPM)	F/Man	Asst. F/Man	C/Man-I	C/Man-II
Organisation					
01.	Organisation of Dockyard/BRO Broad details and functions and responsibilities of departments.	A	A	B	C
02.	Trade structures and trades in Dockyard (both Industrial & non-Industrial)	A	A	B	C
03.	Facilities available in the Dockyard, Power supplies, Berths, Cranes, Air, Water oil and fuel supplies.	A	A	B	C
Safety					
04.	Fire fighting and Prevention, Head fire-fighting appliances.. ..	A	A	A	B
05.	Safety Provisions in force in Dockyard Protective Equipment Common Mechanical, electrical, and chemical hazards, Public Hygiene. First aid techniques.	A	A	A	B
Labour Legislation					
06.	Factory Act rules and its application	B	B	C	C
07.	Wages Act and Workmen's Compensation Act ...	B	B	C	C
Training					
08.	Training Programmes of (Tradesman) Apprentices and Supervisors.	A	A	B	C
09.	Workers Education and Training including Training facilities available in the Dockyard	A	A	B	C
Welfare					
10.	Welfare Measures, Welfare funds, Death benefits, scholarships, Education Allowance, Medical Reimbursement, LTC Claims, Milk issue, food allowance.	A	A	B	B
11.	Loans for GP Funds, INDWP Fund Advance of pay, Festival Advance Bicycle Advance, Fan Advance.	A	A	B	B
12.	Sports activities, library, canteen Bank and other facilities.	A	A	B	B
Security					
13.	Security Measures and Identity cards	A	A	B	B
14.	Official Secret Act, Security of Information	A	A	B	C
Accounting & Documentation					
15.	Types of stores, Accounting procedure, Demanding surveying NSO, WED, SPDC procedure permanent loan ledgers, various forms used.	A	A	B	C

16.	Rendition of various forms used in the Dockyard for stores, administrative and production purposes. Overtime and short leave forms, K forms P forms..	A	A	B	C
17.	Documentation to be kept in ship Test Records, Ship trails etc. Forwarding and Recording of these..	A	A	B	C
Production & Planning					
18.	Process and procedures for assistance from other departments, cooperation and progress of work procedure for requisitioning cranes, Trollies, Lighting connections etc.	A	A	A	B
19.	Work planning, Shop floor planning production and control procedures, Shop estimates, scheduling etc.	A	A	A	B
20.	Productivity, its meaning and importance.	A	A	B	C
21.	Costing and Estimating.	A	A	B	C
22.	Procedures for defect list work, Additions and Alterations, Operational defects.	A	A	B	C
23.	Duties, status and functions of Supervisory staff in relation to (a) Planning and Organisation (b) Maintenance of records (c) Production (d) Quality control (e) Maintenance (f) Control (g) Working conditions and safety (h) Personnel functions	A	A	B	C
Quality Control					
24.	Inspection, Quality control methods, functions..	A	A	B	C
ISO 9000					
25.	An over view of ISO, Describing ISO 9000 series/standards and its various clauses, Difference between 94 version and new ISO 2000 standard..	A	A	B	C
Quality Circles					
26.	Introduction History and concepts of Quality Circles, structure organization of quality circles, methods and techniques of quality circle, concepts and introduction of QC Tools..	A	A	B	C
Total Quality Management					
27.	Definition of Quality, Quality – Productivity Connection, History of Quality and Productivity, Management Styles, Statistical as a Management Tools, Process Management and TQM, Special and Common Cause Variation, Deming's 14 Points Comparison of Traditional Management and TQM, Process Management and Statistics..	A	B	C	C

Planned Preventive Maintenance/Total Preventive Maintenance					
28.	Concept of Maintenance, Advantage of maintenance, planned preventive maintenance, down time concept, Reliability, Total preventive maintenance, Availability as maintainability..	A	A	B	B
ISO 14001					
29.	(a) UN Declaration on Environment and Development (b) UN and National policies on Environment (c) Factories Act provisions on Environment (d) Environmental Management System ISO-14001, Salient Features & requirement (e) Benefits of Environmental Management System (f) Environmental Policy of the Yard (g) Model for Environmental Management System, ISO-14001 Standard (h) Chapter for Sustainable Development	A	B	C	C
Personnel Management					
30.	Recruitment and Promotion rules..	B	B	B	C
31.	Terms and conditions of services with regards to appointment, probation, resignation and discharges.	B	B	B	C
32.	Administrative procedures pertaining to misconduct, disciplinary action, punishment etc. and their effects on the individuals services conditions.	A	A	B	C
33.	Pay and allowances of supervisory and Industrial Staff.	A	A	B	C
34.	Leave, Confirmation rules of Industrial and Non-Industrial employees.	A	A	B	C
35.	Rules for awards and suggestions for improvement of techniques	A	A	B	C
36.	Grievances Machinery.	A	A	B	C
37.	Procedures for dealing with grievances, accidents, injuries of serious and minor nature.	A	A	B	B
38.	Maintenance of service records, Furnishing of particulars of services records, filling up of nomination and family pension forms.	C	C	C	C
39.	Pension and Retirement benefits.	B	B	C	C
40.	System of Mustering, Overtime, Gate passes.	A	A	B	C
41.	Availability of skilled and un skilled man power	A	A	B	C

- A : Complete understanding of the subject
 B : Good knowledge of the subject
 C : working knowledge of the subject

ENGINEERING

Part – A – Common Syllabus for all Engineering Trades

Note :- A meaning of the symbols used in syllabus for the knowledge expected from the various categories is as follows: -

- A - Complete understanding of the subject
 B - Good knowledge of the subject
 C - Working knowledge of the subject

Standard of knowledge
required for promotion to

<u>SNo</u>	<u>Subject</u>	<u>F/M</u>	<u>Asst F/M</u>	<u>C/M-I</u>	<u>C/M-II</u>
01.	Engineering Drawings	A	A	A	B
02.	Engineering Terms including the following:-				
	a) Allowances	A	A	A	A
	b) Tolerance	A	A	A	A
	c) Clearance	A	A	A	A
	d) Ductility	A	A	A	A
	e) Malleability	A	A	A	B
	f) Hardness	A	A	A	A
	g) Temper	A	A	A	A
	h) Jigs	A	A	A	A
	j) Templates	A	A	A	A
03.	Safety and use of equipment				
	a) Cleanliness of working area	A	A	A	A
	b) Fire and safety precautions	A	A	A	A
	c) Hand fire fighting Appliances	A	A	A	A
	d) First aid	A	A	A	A
04.	Weights and measures:				
	a) Calculations for lengths and areas of material required	A	A	A	A
	b) Conversion from inches to	A	A	A	A

	Millimeters and vice-versa				
	c) Rectangle spares area of circles sectors cones	A	A	A	B
05.	Knowledge of engineering materials applicable to the particular trade.	A	A	A	A
06.	Administration				
	a) P forms, K forms accident report forms	A	A	A	B
	b) Action in case of an accident	A	A	A	A
	c) Procedures for demanding spares materials	A	A	A	B
	d) Procedure for requisitioning cranes, Lister,	A	A	A	A
	Lighting connections				
	e) Procedure for requisitioning ATM(M) departments assistance in shop maintenance	A	A	A	B
07.	Man Management	A	A	A	B
08.	Work planning	A	A	A	B
09.	Establishment organization	A	A	A	A
10.	Availability of skilled manpower	A	A	A	B
11.	Preventive measures and importance of personnel and public hygiene	B	B	B	C
12.	Workers education	A	A	A	B
13.	Discipline, entertainer in higher production and greater efficiency. Code of discipline and code of conduct.	A	A	A	B
14.	Productivity – Its meaning and importance	B	B	B	C
15.	Measuring Instruments Including Practical use. (a) Internal and External micrometers venire calipers, depth and height gauges, dial indicators, hardness testers and optical comparators.	A	A	B	C

Part B(a) **SYLLABUS FOR TRADE TESTING EXAMINATION OF MACHINIST**

<u>SNo</u>	<u>Subject</u>	<u>F/M</u>	<u>Asst F/M</u>	<u>C/M-I</u>	<u>C/M-II</u>
01.	Varies types of machines in use in engineering works for production and maintenance jobs-Lathes, Turre and caption lathes, milling machines hobbing and gear shipping machines, precision grinding, drilling, boring and shaping machine, dynamic balancing machines etc. Good knowledge of their operation and uses and limitation.	A	A	B	C
02.	Reclamation of worn out components of machinery by metal deposition and other methods. Limitation of these methods disposal of scraps.	A	A	B	C
03.	Various materials use in a manufacture of components required for ship machinery. Knowledge of their chemical and mechanical property. Use of substitute material other than specified.	A	A	B	C
04.	Jigs and fixtures. Various types of tools and cutters, tooling for batch production work.	A	A	B	C
05.	Heat treatment ferrous and non ferrous materials.	A	A	B	C
06.	Machines use in tool room lathes, shapers Tool and cutter grinder, precision cylindrical and internal grinding machines, milling machines etc. Know-ledge of the operation of these machines high precision work.	A	A	B	C
07.	Abrasive wheels used in tool room work.	A	A	B	C

	Their types and gradings.				
08.	Forging and heat treatment fire hearths, furnaces parameters and their couples etc. Case Carbonising, Cyaniding etc. special emphasise on heat treatment of allied steels, high carbon tools steels and high speed steels.	A	A	B	C
09.	Manufacture of special tools, jigs and fixtures Die making materials used in their manufacture tolerance and clearances.	A	A	B	C
10.	Functioning and maintenance of tools and cribs	A	A	B	C
11.	Meteorology	A	A	B	C

Part B(b) **SYLLABUS FOR TRADE TESTING EXAMINATION FOR *PATTERN MAKERS***

<u>SNo</u>	<u>Subject</u>	<u>F/M</u>	<u>Asst F/M</u>	<u>C/M-I</u>	<u>C/M-II</u>
01.	Safety precautions as applicable trade	A	A	A	B
02.	Reading and marking of from drawings in mm/inch	A	A	A	A
03.	Brief description of materials other than wood and metal use in pattern work (e.g. plaster of paris, wax, araldite, special resins etc.) Their property and uses	A	A	A	B
04.	Patterns – Type of patterns such as one piece pattern, skeleton pattern, mounted pattern etc. and elementary knowledge of metal pattern making.	A	A	A	B
05.	Economic construction of large and intricate pattern, Numbering storing and preservation of patterns, Painting of pattern, Finishing material used in pattern work for e.g. shellac	A	A	B	C
06.	Timbers – Different type of timbers. Their property and uses. Prevention of timber.	A	A	A	B
07.	Inspection – Reduction of scrap by space inspection.	A	A	A	B
08.	Introduction to work simplification related to trade – job study, job analysis, including planning sequence of operation, critical approach and method of working, estimation of time and material, Job handling.	A	A	A	B
09.	Quality and finish of work importance of quality and finish of job in all stages, protection of finish surfaces etc.	A	A	A	B

Part B(C) **SYLLABUS FOR TRADE TESTING EXAMINATION FOR
FOUNDER / MOULDER**

<u>SNo</u>	<u>Subject</u>	<u>F/M</u>	<u>Asst F/M</u>	<u>C/M-I</u>	<u>C/M-II</u>
01.	Safety of work	A	A	A	A
02.	Shrinkage of different metals material manufacturing process of pig iron, malleable cast iron, plain carbon steel, Alloy steel. Cast iron composition – influence of combined and free carbon, influence of other elements e.g. sulphur, silicon, phosphorus etc. on cast iron – manufacturing process of Non-ferrous and other Alloys used in foundry. Alloy cast iron.	A	A	A	B
03	Grating and Feeding system. Description of moulding process- Green sand moulding, dry sand moulding and loam work. Selection of method. Moulding from irregular patterns	A	A	B	B
04	Description of moulding equipment, sands, dressing materials, fire clay, core binders etc. use of exo-thermic compounds (feed ex)	A	A	A	A
05	Knowledge of furnace – cupola, converter, open hearth furnaces, electric furnaces and rotary furnaces, -operating management of cupola and crucible, method of transportation of molten metals – use of ladle etc.	A	A	A	B
06.	Knowledge of common building machines, core making machine, sand slingers.	A	A	B	C
07.	Preparation and uses of moulding sands and refractories properties and uses of foundry fuels and fixtures testing of sand compression and moistures. Testing for clay content refractories and gradation of sand etc.	A	A	A	B
08.	Heat treatment of metals – Annealing, hardening, tempering, normalising and case hardening.	A	A	A	B
09.	Cleaning of casting sands shot an dhydro blasting airless shot blasting and tumbling	A	A	A	B

	barrels, brushes and dust arresters, fettling of castings. Use of hand sawing and sheering grinders, removal of excess metal and repair of casting by gas and arc cutting welding or burning in				
10.	Chilled castings, use of steel castings, influence of alloying elements, non ferrous casting brass – bronze, white metal, aluminium alloy etc. knowledge of centrifugal casting and die casting.	A	A	A	A
11.	Testing of castings	A	A	A	B
12.	CO2 Processing course and moulds making	A	A	A	A
13.	Steel melting and alloy of cast iron	A	A	A	B
14.	Colouring and marking of patterns (ISI)	A	A	A	B
15.	Specification of raw materials (ISI)	A	A	A	B
16.	Salvage of casting	A	A	A	B
17.	Use of tables and manufacturers hand book	A	A	A	B
18.	Modern development in trade	B	B	B	C
19.	Inspection-Reduction of scrap by stage inspection	A	A	A	B
20.	Introduction to work simplification related to trade – job study job analysis including planning of sequence of operation, critical approach and method of working. Estimation of time and material. Job handling	A	A	A	B
21.	Quality and finish of work – importance of quality and finish of jobs at all stages. Protection of finished surfaces etc.	A	A	A	B

Part B**(d) SYLLABUS FOR TRADE TESTING EXAMINATION FOR
ENGINE FITTER**

<u>SNo</u>	<u>Subject</u>	<u>F/M</u>	<u>Asst F/M</u>	<u>C/M-I</u>	<u>C/M-II</u>
01.	Working principles, functions and repair procedures of a) Main propulsion machinery b) Auxiliary machinery viz. Turbo generator HBR compressors VCD compressors main auxiliary feed pump, extraction pumps, force lub oil pumps and centrifugal/ reciprocating pumps and engines steering equipment, maneuvering, valves, safety and pilot valves.	A	A	B	C
02.	Knowledge of : a) Bridge gauge and wear down readings	A	A	B	C
	b) Bearings – Remetaling bedding in boring oil clearances	A	A	B	C
	c) Mitchell – Thrust bearing	A	A	B	C
	d) Speed control governor	A	A	B	C
	e) Over speed trip governors	A	A	B	C
	f) Alignment of main and auxiliary machine	A	A	B	C
	g) Carbon and Librinth glands	A	A	B	C
03.	Chemical cleaning of ferrous and non ferrous material	A	A	B	C
04.	Methods of reclaiming worn out machinery parts	A	A	B	C
05.	Heat exchangers–constructional details and repairs	A	A	B	C
06.	U/W Fittings- ‘A’ Bkt – Stern tube bushes- propellers shafting and rudders	A	A	B	C
07.	Protection from rust and corrosion	A	A	B	C
	Engineering material and their uses	A	A	B	C
08.	Knowledge of flight deck machinery viz. catapults BS –4, Arrestor unit and auxiliary equipment	A	A	B	C
09.	Working principles and repair procedures of refrigeration machinery	A	A	B	C

Part B(e) **SYLLABUS FOR TRADE TESTING EXAMINATION OF
MACHINERY CONTROL FITTER**

<u>SNo</u>	<u>Subject</u>	<u>Foreman</u>	<u>Asstt Foreman</u>	<u>C/M-II</u>	<u>C/M-I</u>
01.	Types of control system fitted on various class of ships	A	A	A	A
02.	Leak proofing methods & testing methods for pneumatic control system pipes.	A	A	A	A
03.	Purpose and description of various control equipment used in pneumatic control system. Viz:- a) Telektron Motor..... b) Controller..... c) Pressure Relay..... d) Differential Pressure transmitter & relay.... e) Steam Transmitter..... f) Water level Transmitter..... g) Lock in relay..... h) Pneumatic Calibrator..... j) TS II Unit..... k) Position Movement Transmitter..... l) Multifunction Relay..... m) Inverse Derivative unit.....	A	A	A	A
04.	Calibration procedure of Pressure, Temperature gauge and multifunction relay	A	A	A	A
05.	Concepts of open loop, closed loop and remote control system.	A	A	A	A
06.	Three element Feed regulator on board Leanders	A	A	A	A
07.	Concepts of proportional, integral and Derivative actions	A	A	A	A
08.	Requirement of servo Air pneumatic control system	A	A	A	A
09.	Components operation and purpose of diaphragms operated valves.	A	A	A	A
10.	Concepts of supply pressure, input pressure and measured pressure w.r.t. pneumatic control equipment.	A	A	A	A
11.	Difference between Pneumatic and Hydraulic control system – Advantages & Disadvantages	A	A	A	A
12.	Description and operation of Orion hydraulic control systems on board Drugs, 1241 Pes and	A	A	A	A

	1241 REs				
13.	Concept of Accumulator in a hydraulic system	A	A	A	A
14.	Concept and types of pneumatic pressure operated equipment on board SSK submarines.	A	A	A	A
15.	Safety & Hygiene related precautions while handling hydraulic control equipment	A	A	A	A
16.	Safety precautions while handling high pressure pneumatic control equipment.	A	A	A	A

- A - Complete understanding of the subject
 B - Good knowledge of the subject
 C - Working knowledge of the subject

Part B

(f) **GENERAL SYLLABUS FOR TRADE TESTING EXAMINATION**
OF
REFRIGERATION & AIR CONDITIONING

FOREMAN ASST. FOREMAN CHARGEMAN I AND CHARGEMAN II

- 1) Should have the complete knowledge of the correct production methods to be used in shop.
- 2) Should have the capacity for keeping in safe custody, maintenance and working of all machinery and tools in the shop and survey of B.E.R. machinery.
- 3) Should have complete knowledge of safety methods e.g. safety against fire etc. and use of first aid kit
- 4) Should have the knowledge of systematic investigation of grievances and requests of the workers.
- 5) Should have the capacity of maintaining an efficient Stores Organization in the shop and should have complete knowledge of store procedure.
- 6) Should have the capacity to train workers in the new production techniques.
- 7) Should have the capacity of taking effective control of the supervisory staff with regard to discipline and order in the shop.
- 8) Should have complete knowledge of the systems of documentation and ability to keep the documents up to date.
- 9) Should have the capacity of organizing an efficient shop administration and delegate responsibilities to subordinate supervisors.
- 10) Should have complete knowledge of the working of the shop control cell.
- 11) Should have the knowledge of basic principles of man management.
- 12) Should be able to plan in detail major refit of a capital ship.
- 13) Detail knowledge on ISO 9002. Quality Circle.
- 14) Reclaiming procedure of worn out parts.

- 15) Alignment procedure
- 16) Knowledge of metallurgy used in various components of A/C ref. Plants.
- 17) Causes of corrosion, erosion and their prevention in A/C ref. Plants.
- 18) Knowledge of Quality control procedure.

**SPECIFIC SYLLABUS FOR REFRIGERATION & AIR CONDITIONING
TRADES IN ADDITION TO ABOVE**

<u>SNo</u>	<u>Subject</u>	<u>Foreman</u>	<u>Asstt Foreman</u>	<u>C/M-II</u>	<u>C/M-I</u>
01.	Working principle of A/C Refrigeration machinery	A	A	A	A
02.	Types of compressors, condensers evaporators	A	A	A	A
	a) Striping	A	A	A	A
	b) Overhauling & testing	A	A	A	A
	c) Trials	A	A	A	A
03.	Alignment of compressor with motor	A	A	A	A
04.	Knowledge of refrigeration used to various plants including their properties, pressure temperature, relation as per type of plant, testing knowledge, safety precautions etc.	A	A	A	A
05.	Knowledge of chemicals, luboils used in refrigeration	A	A	A	A
06.	Knowledge of following:-	A	A	A	A
	a) Pressure testing, vacuum testing, dehydration charging and trial of plant	A	A	A	A
	b) Detection and rectification of running faults	A	A	A	A
	c) Gas circuit & expansion valves removal/overhaul replacement	A	A	A	A
	d) Pipe fitting work related to the trade	A	A	A	A
	e) Testing, Maintenance, servicing the machines excluding electrical side.	A	A	A	A
	f) Trials of A/C & cool & cold rooms plants	A	A	A	A

	g) Calibration/adjustment testing of all types of pressure and temperature cutouts & T.E.V's	A	A	A	A
	h) Repairs and service Valves	A	A	A	A
	j) Bearing-Remetalling bedding up the bearing/Maintaining oil clearance	A	A	A	A
	k) Chemical cleaning of coils, condenser shells ATU's etc. in shop chemical bay	A	A	A	A
07.	Domestic Units	A	A	A	A
	a) Overhaul of scaled unit compressor	A	A	A	A
	b) Circuit diagram of electrical wiring of A/C, refrigeration bottle cooler, water cooler, deep freezer etc.	A	A	A	A
	c) Overhaul of domestic refrigeration & A/C machines.	A	A	A	A
08.	Knowledge of following theoretical terms	A	A	A	A
	a) Ton of refrigeration	A	A	A	A
	b) BTU/K Cal	A	A	A	A
	c) ICE making capacity	A	A	A	A
	d) Co-efficient of performance	A	A	A	A
	e) Heat load calculation	A	A	A	A
	f) HP (Horsepower)	A	A	A	A
09.	Knowledge of practical terms	A	A	A	A
	a) Loading/Unloading mechanism	A	A	A	A
	b) Float control & expansion valves	A	A	A	A
	c) Methods of defrosting	A	A	A	A
	d) Function of oil separators, condensers, chillers receiver, heat exchanger, drier etc.	A	A	A	A
	e) Solenoid valves, back pressure valves, safety devices, pressure relief valves	A	A	A	A
10.	Use of chain blocks, pulley and other lifting appliances	A	A	A	A
11.	Insulating material and its requirement	A	A	A	A
12.	Purpose of fins, grilles, filters in refrigeration	A	A	A	A
13.	Working knowledge of package A/C (AKMK 10, AKMKG, KLIMATI 25, APW THERMOTANK, NEPTUNE A/C)	A	A	A	A

14.	Working knowledge of ALFA LAVAL, KIRLOSKAR YORK, BOCK, STALL, FRIDGEKING, OPEN TYPE COMPRESSOR, ACCCELL SABRO, J&E HALL, RUSSIAN, LIGHT FOOT	A	A	A	A
15.	Working knowledge on Installation of package A/C, Domestic units and split A/C's	A	A	A	A
16.	Proficient in calculation of area, volumes, estimation of weights, materials labour and time	A	A	A	A
17.	Knowledge of different ferrous and non ferrous metals used in refrigeration industry. Their specification, uses & applications.	B	A	A	A
18.	Knowledge of various special type machineries, Rigs used on shop floor, expansion valve testing, temperature controller and monitor calibration test rig, Magnetic crack detection, NDT tests, chemical bay	A	A	A	A
19.	Knowledge of various portable equipments used	A	A	A	A
	a) Digital thermometer				
	b) Electronic leak detector				
	c) Portable blower unit with hot attachment				
	d) Anemometer				
	e) Pressure/compound gauges				
	f) Sling psychrometer				
	g) Dry & wet bulb thermometers				
20.	Technical knowledge of all type of insulating material used in refrigeration industry.	B	A	A	A
21.	Should be capable of independently undertaking installation on central plants, package A/C unit, slit A/C unit from drawing material provided.	A	A	A	A
22.	Should be capable of undertaking Degutting & Re-gutting of A/C & refrigeration plants independently.	A	A	A	A
23.	Should be capable of carrying out Air run test/Volumetric efficiency test on A/C & Refrigeration Compressor.	A	A	A	A

24.	Should have detailed knowledge of stores accounting procedure of material and manpower function of the control cell and contract review(WI)	A	A	A	A
25.	Should have detail knowledge of role of the dept. and centres. Type of assistance required for the job entrusted from various other centres & coordination with them.	A	A	A	A
26.	Train & grade all lower categories of tradesman and labourers and supervisors.	B	B	A	A
27.	Should be able to plan work for future estimate material requirement and exactly make a time estimate of any job and submit report.	B	A	A	A
28.	Should be conversant of ISO 9002 procedure and application of them in the centres.	B	A	A	A
29.	Should be aware of the safety practices while undertaking work onboard, in chemical bay and safety gears/for fighting equipment etc.	A	A	A	A
30.	Should be able to communicate thoroughly in English and Hindi in all aspect of work with supervisors.	B	A	A	A
31.	Should be able to accurately specification of various materials and products.	B	B	A	A
32.	Should be able to understand, appreciate the technical drawing/documents and various INSMA acquaint, BR's and be conversant with procedures of all types of A/C & refrigeration plants.	B	A	A	A
33.	Should be able to inspect certify all type of spares materials used and inspect/rectify tests on various equipment/plants of A/C and refrigeration.	B	A	A	A
34.	Should have sound knowledge of operation and test of material handling equipments, lifting gears, measuring instruments used on shop floor.	B	A	A	A

Part B**(g) SYLLABUS FOR TRADE TESTING EXAMINATION OF
I.C.E & GT****SYLLABUS FOR I.C.E. TRADE IN THE GRADE OF F/M, ASST. FOREMAN,
C/M-I, C/M-II**

What a Diesel Engine is How a Diesel Engine works, Compression Ratio, Difference between Diesel Engines and Gasoline Engines.

Distinguishing features of Diesel Engines, How and why Diesel Engines differ from each other, What a supercharger is- types of supercharger.

Lubricating oil-different grades-wedge theory-properties of oil.

Engine power and Fuel combustion, Indicated power, Brake Horse power, Torque, Brake Mean effective pressure, Efficiency.

Classification of Engines, Study of cylinder heads, cylinder Blocks, Piston Assemblies, cylinder liners, Piston Rings, Connecting Rods, Gudgeon pins, Camshafts, Crankshafts, Main & Big end bearings Fly wheels.

Valve Gear, Scavenging, valve Actuating Gear valve timing, Scavenging pumps, scavenging Blowers, Supercharging & systems.

Fuel-injection system, Air injection common-Rail system-unit injection system, Distributors, Design spray valves, Fuel Nozzles.

Types of combustion chambers, Lubrication systems, Fuel oil circulation system and Fresh water/sea-water circulation systems.

Governors-Types of Governors-calibration of Governors, Fuel pumps and Injectors- Reconditioning of Fuel oil Equipments.

Auxiliary systems-types of starting systems of Diesel Engines Running-in-period of Engines-study of maintenance Schedules-Alignments of main propulsion & D/As/DGs- Load Trials-parameters Assessment Defects, Remedies-specific Defectation, Decarbonisation (Top Overhaul) Major Inspection and Major Overhaul of Diesel Engines.

**SYLLABUS FOR G.T. TRADE IN THE GRADE OF F/M, ASST. FOREMAN,
C/M-I, C/M-II**

(a) Installation of Main G.Ts.

(i) Preparation for lifting off G.T. unfastening of all system pipes, blanking of foundation holes, Grinding, Filing and bedding of foundations, lowering of G.T. and shiftweight of G.T. on jack Bolts, fitting of check coupling on R/G, flange and fitment of cardon shaaft, Alignment of G.T. to RG, shifting of Dynamometer Load onto jack Bolts and Fitments of S/V Mountings, Estimation of choke plate thickness, manufacturing of choke plates as per requirement, Marking position of new holes on foundation, Lifting of G.T. & drilling new holes, insertion of choke plates in respective position, lowering of jacks and alignment of G.T. with R/G securing foundation Bolts, Lowering of Exhaust Involutes and setting of telescopic clearances and fitment of all system pipes, checking of Retainer clearance, checking of Reference bolt clearance and checking of Thermal stretch.

(b) Repair/Routines on Gear Boxes, Dismounting of Turning Motor, Disconnection of all system pipes, Dismantle Jaw Coupling, Removal of Top & slide covers, Disconnection of friction Gear Z3 from Z2 & Z1 from Z5 Gear, Removal of toothed clutch from Z3 Gear, Removal of sprayer & bracket and End cover of Z3 Gear, Removal of Lub oil pump and cluster Gear, Dismantling oil pump drive, Disconnecting of Friction Coupling from Z3 Gear and if required, to dismantle Friction Coupling, Inspection of Friction, Hydraulic Coupling and Lub oil pump Drive, Modifications/Repairs of Friction or Hydraulic Couplings, Checking of oil Clearances of shell bearings and inspection of gears.

(c) Installation of GTA.

Checking of Run out of Main Shaft, Maintenance of clearances pertaining to Exhaust system. Preparation for lifting of Aggregates by disconnecting all system piping and cardon shafts and foundation bolts and also shifting the G.T. & R/G.

(d) Installation of GTG T/C

Disconnecting all system lines, that is, Lub oil, Fuel, Exhaust and intake and prepare for removal of Turbo compressor, cleanliness of

foundation of T/C and preparation to be done for lowering of new T/C, install & Align T/C.

Decoupling of old R/G from T/C and Generator, unfastening of system pipes and foundation bolts, sling R/G and lift off the Engine Room, Install new R/G in position, Maintenance of all distances and alignment, Reconnect all system pipes and Recheck alignment

(e) Testing & calibration of G.T. Fuel Equipments.

Burner, Plunger pumps, Automatic Fuel control unit (AFCU). Dump valve, stop cock, Drain Valve, Starting Cock, Emergency Valve and Magnetic Cock.

BASIC KNOWLEDGE OF 'GAS TURBINE' OR INTERNAL COMBUSTION TURBINE :

Three main components, that is,

- | | | | | |
|-----|------------|-----|--------------------|-----|
| (a) | Compressor | (b) | Combustion chamber | (c) |
| | Turbine | | | |

Main two factor that affect the performance :

- | | | | |
|-----|------------------------|-----|-----------------------------|
| (a) | Component efficiencies | (b) | Turbine working Temperature |
|-----|------------------------|-----|-----------------------------|

Types of Gas Turbines :

Divided into two general classes, that is,

- | | | | |
|-----|----------------------------|-----|---------------------|
| (a) | Dynamic or Air Craft units | (b) | Static power plants |
|-----|----------------------------|-----|---------------------|

Simple Construction and Operation of Simple Turbines

Low pressure Compressor, high Pressure Compressor, Combustion Chamber, High pressure Turbine, Pressure Turbine, Propulsion Turbine & a Gas Exhaust.

Part B**(h) SYLLABUS FOR TRADE TESTING EXAMINATION OF
BOILER MAKER / INSULATION**

1. Meaning of the symbols used in syllabus for the standard of knowledge expected from the various categories is as follows: -

- A - Complete understanding of subject
 B - Good knowledge of the subject
 C - Working knowledge of the subject

S No	Subject	F/M	Asst F/M	C/M-I	C/M-II
(a)	General constructions of boilers i.e. drums, casings internal / external fittings	A	A	A	A
(b)	Details of tubes (materials thickness, sizes) used in boilers	A	A	A	A
(c)	Knowledge of material used in boiler construction	A	A	A	A
(d)	Knowledge of plates used in boilers / casings etc	A	A	A	A
(e)	Tube measurements	A	A	A	A
(f)	Bending & setting of tubes to templates and gauges	A	A	A	A
(g)	Laying of boilers as per drawings	A	A	A	A
(h)	Removal and refitting of boiler tubes, internal fittings of steam & water drums, soot blowers, headers	A	A	A	A
(j)	Knowledge of operation & Maintenance of pneumatic rolling machines / wpt pumps	A	A	A	A
(k)	Boiler expansion arrangements	A	A	A	A
(l)	Knowledge of brick work and refractory materials	A	A	A	A
(m)	Unfitting and refitting of registers / steam atomisation	A	A	A	A
(n)	Development of Geometrical figures	A	A	A	A
(p)	Making of templates / gauges, jigs and fixtures etc	A	A	A	A
(q)	Knowledge of welding	A	A	A	A
(r)	Knowledge of machines in boiler shop	A	A	A	A
(s)	Method of special repairs to boiler pressure parts such as cracks in tube plates, damages to tube holes and hand / man hole doors and seats	A	A	A	A

(t)	Various pressure testing of boilers	A	A	A	A
(u)	Knowledge of Pert Chart				
(v)	Water Washing and chemical cleaning of boilers	A	A	A	B
(w)	Knowledge of non destructive test of boilers	A	A	A	A

Part B**(j) SYLLABUS FOR TRADE TESTING EXAMINATION OF PIPE FITTER****GRADE- F/MAN, ASST. FOREMAN, C/MAN-I, C/MAN-II**

1. **Safety Measure:** Safety precaution for shop floor, on board ship and general installation.
2. **Common Hand Tools:** Files, Hacksaw, Chisel, Hammer, Punches, Spanners, Vices, Screwdrivers, Try square, Drills, Taps, Dies, Scrappers, Wrenches.
3. **Measuring Tools:** Vernier Calipers, Micrometers, Feeler Gauges.
4. **Fitting Operation:** Filing, Chipping, Grinding, Hacksawing, Drilling, Threading.
5. **Methods of Welding, Soldering and Brazing:** Definition and Types.
6. **Pipe Bending: Hot** and Cold Bending Process.
7. **Annealing and Burning of Pipes :** Process
8. **Chemical Cleaning :** Process
9. **Calculation of volume and weight of pipes** of different diameters and thickness.
10. **Theory regarding rod templating and sheet templating.**
11. **Metals:** Ferrous-ores, Wrought Iron, Cast Iron, Steel.
12. **Non-Ferrous metal:** Lead, Tin, Copper, Brass, Aluminum, Polythene.
13. **Heat Treatment of Metal:** Annealing, Hardening, tempering, Normalizing-Process.
14. **Properties of metal:** Strength, Tenacity, Elasticity, Hardness, Toughness, Malleability, Ductility, Brittleness-Definition.
15. **Pipes:** Description-Steel Pipe, Cast Iron Pipe, Copper Pipe, GI Pipes.
16. **Standard Pipe fittings:** Steel Bend, Socket, Tee piece, Y piece, Reducers, Coupling, Unions, Check nuts-Define.

17. **Pipe Joints:** Bell and Spigot joint, Flanged joint, threaded joint.
18. **Valves:** Globe Valve, Gate valve, Screw down valve, Non Return valve, Angle type stop valve, Reducing valve, Safety valve, Relief valve.
19. **Cocks:** Straight way cock, Three way Cocks, Four way Cocks, Drain Cocks.
20. **Taps:** Bit Taps, Pillar Taps, Push Taps, Half turn Taps-Definition.
21. **Fitting on piping system:** Thermometer, Manometer, Filter and Mud-Box.
22. **Methods of pipe manufacturing:** Seamless and Welded pipe.
23. **Type of jointing Material and their use:** Rubber, Leather, Asbestos, Copper, Joint compound.
24. **Pipe Fitting Practice:** Templating, Fabrication, Testing, Clamping and supporting the pipe.
25. **General study of Hull piping system:**
 - (a) Bilge and Ballast systems
 - (b) Air and over flow piping
 - (c) Sounding Pipes
 - (d) Fire main and Wash deck piping
 - (e) CO₂ systems smoke detecting arrangements.
 - (f) Compressed air system for deck service.
 - (g) Drainage system.
26. **Machinery piping system:**
 - (a) Compressed Air Systems.
 - (b) Lub oil system for main and auxiliary engine.
 - (c) Fuel oil system for main engine and boiler fittings, transfer purification and service.
 - (d) Diesel oil system, Filling & transfer, purification service.
 - (e) Cooling water system:
 - (I) Fresh Cooling water
 - (II) Sea cooling water
 - (f) Exhaust gas piping system, Main Engine and auxiliary engine boilers.

ELECTRICAL

Part – A – Common Syllabus for Electrical Trade

Note :- A meaning of the symbols used in syllabus for the knowledge expected from the various categories is as follows: -

- A - Complete understanding of the subject
 B - Good knowledge of the subject
 C - Working knowledge of the subject

Standard of knowledge
required for promotion to

<u>SNo</u>	<u>Subject</u>	<u>F/M</u>	<u>Asst F/M</u>	<u>C/M-I</u>	<u>C/M-II</u>
01.	Safety and use of equipment				
	a) Cleanliness of working area	A	A	A	A
	b) Fire and safety precautions	A	A	A	A
	c) Hand fire fighting Appliances	A	A	A	A
	d) First aid	A	A	A	A
02.	Administration				
	a) P forms, K forms accident report forms	A	A	A	B
	b) Action in case of an accident	A	A	A	A
	c) Procedures for demanding spares materials	A	A	A	B
	d) Procedure for requisitioning cranes, Lister, Lighting connections	A	A	A	A
	e) Procedure for requisitioning ATM(M) departments assistance in shop maintenance	A	A	A	B
03.	Man Management	A	A	A	B
04.	Work planning	A	A	A	B
05.	Establishment organization	A	A	A	A
06.	Availability of skilled manpower	A	A	A	B
07.	Preventive measures and importance of personnel and public	B	B	B	C

	hygiene				
08.	Workers education	A	A	A	B
09.	Discipline, entertrainer in higher production and greater efficiency. Code of discipline and code of conduct.	A	A	A	B
10.	Productivity – Its meaning and importance	B	B	B	C

Part B

(a) SYLLABUS FOR TRADE TESTING EXAMINATION OF POWER

For Foreman , Asst. Foreman and Chargeman-I (Power)

1. Syllabus will be common for Chargeman-I (Power), Asst. Foreman (Power), Foreman (Power). They will be expected to possess knowledge in depth of Electrical Technology including mathematical treatment of circuit theory and vectorial representation of electrical quantities. In addition in so far as Electrical machinery and switch gear are concerned detailed knowledge in operation and maintenance including elementary treatment of design aspects will also be expected of Foreman and Asst. Foreman.
2. Candidates will be examined in:
 - (a) Basic Electrical Engineering and
 - (b) Electrical Machinery and Switch gear.
3. Professional Syllabus for the above mentioned subjects will be as follows:-
 - (a) **Basic Electrical Engineering:**
 - (i) Units and Dimension factors determining resistance of a conductor, dependence on temperature, colour code, Calculations.
 - (ii) **Electro Magnetism.** Magnetic fields due to current carrying conductors solenoids etc. magnetizing force, flux density, Permeability B/H curves. The magnetic circuit, M.M.F. and Reluctance. Effect of air gap. Induced EMF, Faraday's and Lenz's Laws. Self induction and Mutual inductions. Hysteresis and eddy current losses; calculations.
 - (iii) **Electrostatics.** Electric field between parallel plates, Electric Force, capacitance; calculations.
 - (iv) **Circuit Theory.** Three circuit elements (Resistance, inductance and capacitance) Ohm's Law and Kirchhoff's Laws. Solution of series and parallel network. Power in circuits, power factor. Two and three phase supplies; star and Delta Connections. Relation between line and phase values. Sine wave calculations/vectorial representations.

(v) **Measuring Instruments.** Basic principles of Moving Coil, Moving iron, Electrostatic meters, ammeters, Voltmeters, Ohmmeters, Meggers, Multimeters etc.

(vi) **Miscellaneous Electrolysis.** Process of Electroplating Plating solutions, compositions of copper, Nickel, Silver etc. plating Amperage required for various materials. Acid cleaning. Pickles and dips. Galvanising. Process of chromium plating, Hardchrome deposition.

(b) **Electrical Machinery and Switch gear :**

(i) **DPC Generators.** Principle of operation, constructional details of armature winding, Types shunt, series, compound, Level and over compounding. Parallel operation and load sharing. Armature Reaction. Effects of air gap. Meta-dyne, Principle of Operation. Meta-dyne as a rotary amplifier.

(ii) **D.C. Motors.** Types-Series Shunt, Compound speed/Torque characteristics. Critical resistance. Armature Reaction, methods of overcoming. Speed control, Ward-Leonard System. Types of enclosures etc.

(iii) **Transformers.** Principles, types of winding-Shall type, Core and Sandwich type, Method of cooling. Losses—Copper, Hysterisis and Eddy Current.

(iv) **Alternators.** Principle, constructional details, relation between speed and frequency. Revolving field of an alternator. Service applications—Parallel running, conditions/procedure, Implication of connecting 400V, 50 Cycle Shore supply a.c. frigates. Bonding of Adjacent Ships—Emergency a.c. supply systems on board ships—normal, alternative and converted supplies.

(v) **AC Motors :**

(a) Mechanical Construction. Types of synchronous motors. Rotating magnetic field. Squirrel cage induction motor. Theory of operation, slip calculation: ship torque characteristics, Double squirrel cage induction motor. Cogging/crawling. Single phase motor.

(b) Service applications of squirrel cage motors—speed control of A.C. capstan motor interlocks; Boat Hoist Winch motor and control system in A.C. ship.

(vi) Starters/Controllers, switchgear :

(a) Function of starters/Controllers, Admiralty requirement of d.c. motor or starters and controllers—speed Controllers (A.C. & D.C.) with sketches.

(b) A.C. Switchgear—supply breaker, feeder breaker, I/C breaker etc.—Operation and circuit diagrams. Protective devices in service switchgear—over current, reverse power, under-voltage, time discrimination etc.

(c) A.C. Starters—service application. Motor protection Motor O/L protection types. Single phasing protection. Starter overload Test Set, use of and procedure for setting up. Types of O/L Retarders in a.c. Motor Starters.

(vii) Engine/Turbine Protection. Engine Protection Equipment, Warning Devices, Turbine Protection.**(viii) Electrical Workshop Practice :**

(a) Knowledge of use and maintenance of general handtools, gauge, instruments like Voltmeter, Ammeter, Wattmeter (a.c. & d.c.) Power Factor meter, Phase sequence Indicator/ Synchroscope, Multimeter, H.T. Cable testers, Time of operation test set, primary and secondary current. Injector for O/L Calibration of starter and circuit breaker, ammeter shunts, CT & PT.

(b) Technique of overhaul, repair installation, alignment, test/trials of generators, alternators, a.c. and d.c. Motors Converters. B.S. specification for insulation resistance of Electric Machinery. Drying out of A.C. and D.C. Machines—oven, convection heating, circulating current; Electrical Insulating Materials; Insulating Varnishes—Air drying, Oxidising Baking, thermo-setting procedures; operation of vacuum Impregnating Plant.

(c) Methods of locating open and short circuits in Armature Windings. Methods of locating No Load Neutral on Electrical rotating machines—voltage test, speed method, inductive kick method etc.

(d) Technique of overhaul repair installation test and trials of switchgear, starters, controllers; overhaul/repair and tests of domestic equipments such as Electric heaters, Electric Boilers, Electric Galley and cooking ranges. Motor Boat Equipment, Batteries, Various electric fittings.

(e) Wiring Practice. Various methods of wiring cleats, wooden casings batton conduits channel/carrier plating, undergrounds, overhead and submarine cabling techniques.

For Chargeman-II (Power)

1. Candidates for the post of Chargeman-II (Power) will be examined in Basic Electrical Engineering and Electrical Machinery and Switchgears.

2. Professional Syllabus for the above mentioned subject will be as follows :-

(a) Basic Electrical Engineering:

(i) Units and Dimension factors determining resistance of a conductor, dependence on temperature, colour core.

(ii) **Electro Magnetism.** Magnetic fields due to current carrying conductors, Magnetizing Force, Flux Density, Permeability B/H curves the magnetic circuit. M.M.F. and reluctance. Effect of air gap. Induced BMF, Faraday's and Lenz's Lans. Self induction and Mutual inductions. Hysterisis and eddy current lesses.

(iii) **Electrostatics.** Electric field between parallel plates, Electric Force, capacitance.

(iv) **Circuit Theory.** Three circuit elements resistance, inductant and capacitance Ohm's Law and Kcrehoff's Laws. Solution of series and parallel networks. Power in circuits, power factor. Two and three phase supplies. Step and Delta Connections. Relation between line and phase values.

(v) **Measuring Instruments.** Basic principles of Moving Coil, Moving Iron, Electrostatic meters, ammeters, Voltmeters, Ohmmeters, Meggars, Multi-meters.

(b) Electrical Machinery and Switchgear :

(i) **D.C. Generators.** Principles constructional details of armature winding, commutation. Types--shunt, series, compound, Characteristics. Parallel operation.

(ii) **D.C. Motors.** Types-Series, Shunt, Compound characteristics. (Speeds and Torque), Uses Sketches.

(iii) **Transformers.** Principle, Type of winding-Shell type, Core types and Sandwich type, Methods of cooling. Losses—Copper, Hysteresis and Eddy Current.

(iv) **Alternators.** Principles, constructional details, relation between speed and frequency. Parallel operation and loadsharing.

(v) **AC Motors.** Types of Synchronous Motor Induction Motors. (Squirrel Cage and wound rotors), Constructional details uses.

(vi) **Switchgear Starters and Controllers.** Function, main features of operating coil and reverse current protection remote operation. Types of A.C. starters, Direct on Star Delta—Auto Transformer, speed Controllers (A.C. & D.C.) with sketches.

(vii) **Electrical Workshop Practice.** Knowledge of use and maintenance of general hand tools, gauge, instruments like Voltmeter. Ammeter, Wattmeter (A.C. & D.C.) Power Factor Foltter, Synchroscope, Multi-meter, H.T. Cable Tests. Time of operation Test Set, Primary and Secondary current layictor for O/L Calibration of starters and Breakers, Ammeters shunts, CT & PT Technique of overhaul, repair installation alignment Test and trials of Generators, Alternators, A.C. and D.C. Motors Converters.

(c) Technique of overhaul repair installation tests and trials of switchgear, starters, controllers and domestic equipment such as Electric Heaters, Boilers, Electric Galley and cooking ranges. Motor Boat Equipment, Batteries, Various Electric Fittings.

(d) Technique of overhaul repair and installation of Engine protective devices such as auto-shunt down panels, their calibration etc.

(e) Wiring. Various methods of wiring—Boats wooden casings..

WEAPONS

Part – A – Common Syllabus for All Weapon Trades

Note :- A meaning of the symbols used in syllabus for the knowledge expected from the various categories is as follows: -

- A - Complete understanding of the subject
 B - Good knowledge of the subject
 C - Working knowledge of the subject

Standard of knowledge
required for promotion to

<u>SNo</u>	<u>Subject</u>	<u>F/M</u>	<u>Asst F/M</u>	<u>C/M-I</u>	<u>C/M-II</u>
01.	Safety and use of equipment				
	a) Cleanliness of working area	A	A	A	A
	b) Fire and safety precautions	A	A	A	A
	c) Hand fire fighting Appliances	A	A	A	A
	d) First aid	A	A	A	A
02.	Administration				
	a) P forms, K forms accident report forms	A	A	A	B
	b) Action in case of an accident	A	A	A	A
	c) Procedures for demanding spares materials	A	A	A	B
	d) Procedure for requisitioning cranes, Lister, Lighting connections	A	A	A	A
	e) Procedure for requisitioning ATM(M) departments assistance in shop maintenance	A	A	A	B
03.	Man Management	A	A	A	B
04.	Work planning	A	A	A	B

05.	Establishment organization	A	A	A	A
06.	Availability of skilled manpower	A	A	A	B
07.	Preventive measures and importance of personnel and public hygiene	B	B	B	C
08.	Workers education	A	A	A	B
09.	Discipline, entertrainer in higher production and greater efficiency. Code of discipline and code of conduct.	A	A	A	B
10.	Productivity – Its meaning and importance	B	B	B	C

Part B

(a) **SYLLABUS FOR TRADE TESTING EXAMINATION OF *WEAPON***

For Chargeman – I, Asst Foreman and Foreman.

1. **Basic Mechanical Engineering:**

- (a) ***Lubrication and preservation:*** Types of lubrication, lubricators, self lubricating bearings, lubricants and their requirements for various uses, Preservation.
- (b) ***Maintenance of Hydraulic Components:***
- i. Hydraulic leathers, Oil seals and retainers, Housing tolerance and limits, Synthetic rubber seals, chevron seals.
 - ii. A.E.L. pipe joints: Fitting instructions, nylon nipple joints, shrouded 'o' seals and spiral wound gaskets.
 - iii. Erueto Couplings: Flexible hydraulic hoses, oil separators, streamline filters, British filters.
 - iv. Hydraulic Hygiene: Contamination sources, filtrations, degree of filtration, types of filtration systems, system flushing sampling and testing of oil.
- (c) ***Use of Optical and Telemetry Equipment :*** Theodolite, binoculars, D.A.B.S. bore telescope, clinometers, levels, micrometers, dial gauges, feeler gauges, caliper, sigma comparator.
- (d) ***Various types of ball and roller bearings:*** Ball journal bearing, Angular contact double purpose bearings, roller bearings, ball thrust bearings, gyro bearings, air bearings diametrical freedom, lubrication, preservation, Timken tapered roller bearings and gauges, feeler gauges, caliper, sigma comparator.
- (e) ***Corrosion and Protection against Corrosion:*** Parkersing, blueing, slinging and lifting.
- (f) ***Fits and Tolerances:*** B.S. 1916 press, light driving, keying fit, push fit, average location, precision location (close running 1st quality and close sliding) average running precision running or loose fit.

2. **H.P. Air System:**

a) H.P. Air Testing of H.P. Air system, proof testing of H.P. Air cylinders/bottles, hydraulic accumulators, oxygen bottles, ASBA cylinders. Annealing cleaning and water pressure testing of short connecting copper pipes and unions between cylinders. Testing, refitting, resetting of relief and reducer valves. Testing of H.P. Air and hydraulic hoses, dehydrators, filters, charging nozzles.

b) C.C.A. Gear : Precautions while handling, Surveying of acid pressure testing of acid containers.

3. **Weapon mountains, Directors and Torpedo Tubes:** Examination refit maintenance, overhaul and repairs of elevation and training gear boxes, training bases, roller paths, clips, trunnion assemblies ammunition hoists, rammers, flash doors, weathering systems, cradle recoil cylinders, recuperators, intensifiers, training and elevation limit gear, drenching system, training buffers, locking bolts, window cleaning gears, gun shields, clino planes, cooling water system, air blast system, and mountings range valves, depth setting gear, handling room equipment depth charge throwers, R.F.L. equipment, saluting guns, torpedo tubes.

4. **Installation of Weapons:** Installation of weapons as per drawings and inspection at various stages, setting to work of major units. Testing of gun sights and director sight. Datum marks for checking alignment of directors and sights. Tilt tests. Parallelism test of director installations.

5. **Armament Alignment:** Purpose, explanation of alignment terms Master sights, master training datum, common datum, installation scribe lines, final mechanical alignment test, datum bench marks, system bench marks, datum scribe lines, bench mark alignment test equipment (weapon) sealings, datum and bench marks and fitting instructions, alignment tests and must know approved racking positions.

6. **Inspection & Quality Control:**

(a) **Test & Trails:** pre-refit trails quality control during repairs stage and final inspection of weapons as per test specifications capacity and machinery test on hydraulic pumps and engines (VSG Test, pulling back of gun and inspecting, slip test, sight tests, breech travel roller clearances, training slip clearances, firing arcs, safety arcs, lug clearances, hysteresis test, slow rotational torque test, backlash test, hand efforts, brakes, friction clutch slipping efforts, training and elevation limits maximum speeds, positional accuracy test, director erection test, hoists test, slip test, preparation for firing, gun trails, lift test, post refit trails and harbour acceptance trails of major units.

(b) **Equipment** : Pre-refit trials, repairs, overhaul, stage inspection, quality control, final inspection, subassembly and major unit testing as per specifications of equipment. Also setting to working after installation on board ship. Post refit and harbour trials.

(c) **Gun Mountings** : Turrets and gun mountings in use in the service.

76.2 mm Gun Mountings
 AK 176 Gun Mountings
 AK 630 Gun Mountings
 AK 230 Gun Mountings
 AK 100 Gun Mountings
 AK 725 Gun Mountings
 4.5 inch mounting

7. **Directors**: Torpedo tubes. All types of ammunition hoists, depth charge throwers, electro hydraulic units, hydraulic and firing cylinders.

For Chargeman-II (Weapons)

1. Bearings Timmken tapered roller bearings, floating bearings location, adjustment for pre-loading.
2. **Test and Trials** : Pulling back of gun and inspecting slip test, sight tests, breach travel roller clearances, training clip clearances, fire arcs safety arcs, leg clearances, gun trial, measurement of recoil, tilt test, tilt liners, hysteresis test, slow rotational torque test, backload test, hand efforts, brackes, friction clutch training and elevation limits, buffers, maximum speeds, capacity tests of pumps, positional accuracy tests, Director erection test.
3. **Alignment** : Datum marks for checking alignment of directors, sights and stabilizing equipment, parallelism test of directors, Master Training Datum, mechanical alignment. Installation Distant object alignment test, Datum bench marks, system bench marks. Use of clinometers and theodolites. Overhaul and shop testing of all sub-assemblies and major units of mountings and directors as per test specifications.
4. **Drawing** : Should be able to make out simple sketches of mechanical parts and follow machine drawings.
5. **Specifications** : Should be able to read and understand and explain to juniors technical details from BRs, and books specification and drawings.

COMMON SYLLABUS FOR ELECTRONIC BASED TRADE

Introduction

- The syllabus given in the succeeding pages is a guide for the personnel and trade examiners to prepare/examine for the Departmental promotion Examinations. The syllabus is structured as follows:-

Basic Electricity	-	Common to all Electronic Based trades
Basic Electronics	-	Common to all Electronic Based trades
Advanced Electronics	-	Common for all Electronic Based Trades except Control Fitter (Gyro) and Control Fitter (Instrument)

- The syllabus is applicable for departmental promotion examinations of all grades with following specific differentiation

<u>Sl. No.</u>	<u>Promotion to Grade</u>	<u>Standard of Knowledge</u>
(a)	C/Man - II & C/Man - I	A : Advanced Detailed understanding of specific systems, Block diagram level understanding of all systems handled by that trade, specialization in all fields of the trade, Managerial and Administrative functions.
(b)	Asst. F/Man & F/Man	B : Advanced Block diagram level understanding of all system handled by that trade, specialization in all fields of the trade, Deep understanding of Managerial and administrative functions.

BASIC ELECTRICITY

- Introduction to Electricity**. Voltage, current and resistors, basic meters, Ohm's Law, specific resistance, common conductors and their properties, standard sizes, current ratings, S.W.G., metric gauge and wire

tables, insulating materials and effects of current, heat, power, temp, coefficients, N.T.C. resistors, circuits, symbols-therraistor.

2. **Resisters.** Construction of carbon resistor colour coat, all types of metal. Wooden liner and non-liner wire wound resistors. Thermistor, potentiometer (carbon, wire wound liner and logarithmic) series and parallel connection of resistors, gang resistors, resistance current and power rating, Kerchief's law and application.
3. **Battery.** Simple Leclanche cell (dry cell, storage precaution) lead acid accumulator (principle, construction, charging ampere hour capacity, battery charger) battery in an electric circuit, series parallel and option connection. Wheat stone bridge silver oxide L.C.R. button cell, resistance of battery. Magnetism, magnets (different permanent magnets). Magnetic field, electromagnetism, coil with iron core, permeability, different magnetic materials and properties relay. Current relative in relay pick ups and relay valves.
4. **Simple Meters.** Moving iron and moving coil meters (Principle constructions and special feature) and accessories universal meter, shunt voltage, measurement, meter multiplier, sensitivity current, measurement, multimeter.
5. **Alternating Current.** What is AC. Induced voltage and current. Faraday's principles. Lenz's Law self induction, AC Generator, Fleming's three finger rule, frequency, peak, average RMS. Valves, phase, cycle, dynamometer, vibrators. Resistance on AC and DC fractional HP motor.
6. Revision of Electromagnetic Induction, principle of induced e.m.f., Faraday's laws and Lenz's law.
7. **DC Generators.** Generator principle, simple loop generator, construction and working. Main parts of a practical generator – Yoke, pole cores and pole shoes, pole coils, armature core, armature winding commutator brushes and bearings. Armature winding, pole pitch, conductor, coil pitch, pitch of winding, back pitch front pitch, resultant pitch, commutator pitch, single layer winding two layer winding, simplex wave winding, numbering of coils and commutator segments, simplex lap winding dummy coils use of lap wave winding dummy coils use of lap wave windings.
8. **Types of Generators.** Separately excited generator, self excited shunt wound, series wound and compound wound.
9. **DC Motors.** Motor principle – comparison of generator and motor action, significance of back e.m.f.

10. **Induction Motors.** Advantages and disadvantages, construction stator, and rotor squirrel cage rotor, phase wound rotor, production of rotating field three phase supply principle of operation. Synchronous speed, slip and slip speed, measurement of slip frequency of rotor current, relation between torque and power factor, starting torque of squirrel cage rotor and slip ring motor, effect of change in supply voltage various losses, rotor efficiency.
11. **Transformers.**
- Working principles, transformers constructions, core type transformers.
 - Theory of an ideal transformer, EMF equation, voltage transformation ratio.
 - Transformer on no load and on load.
 - Transformer tests – open circuit and short circuit tests.
 - Regulation of transformers, losses in a transformer, efficiency of a transformer, variation of efficiency with power factor.
12. **Three Phase Transformers.**
- General connections, star delta-star, star-star, delta-delta, open delta and slot auto
 - Auto transformers, instrument transformers, current and potential transformers.

Study Material.

- Electrical Technology by BL Thereja
- Electricity (set of 7 volumes) by Henry Mileaf

ADVANCED ELECTRONICS

Electronic Materials & Components

- Switches and Relays.** SPST, SPDT, DPST and SPDT. Micro thumb wheel lever, cross bar and proximity switches, Principle of operation, types of relays and their construction, operation, specifications, testing and applications.
- Integrated Circuit.** Monolithic IC, thick and thin film IC, hybrid IC, linear and digital ICs. Manufacturing process, fabrication of active components of IC, isolation techniques, IC packaging and package types.

3. **Printed Circuit Board.** Types of PCB, production of PCB, artwork etching, soldering and artwork using computer.

Introduction to Microprocessors

4. **Introduction to 8085 Instruction Set.** Detailed study of all instructions in 8085.
5. **Programming with 8085.** Assembly language programs, additions of two 8-bit Nos., 8bit subtraction, 16-bit addition, decimal addition and subtraction. One's complement, two's complement, masking a particular bit, larger of two numbers, smaller of two numbers, 8-bit multiplication and timing delays.
6. **Software development Systems and Assemblers.** Components of software development systems, types of operating systems, types of operating system of a computer, editor, assemblers and compilers.

Advance LIC

7. **Timer Circuits.** Study of timer IC 555 specifications, features, block diagram. Working, pin configurations, 555 as a astable & monostable multivibrator. Applications of 555. applications of 555 as bistable multivibrator, square wave generator and pulse stretcher.
8. **Waveform Generators.** Since wave oscillators, phase shift circuits, bridge oscillator with amplitude stabilisation, triangular wave & staircase generator.
9. **Phase-Lock Loop.** Block diagram of PLL, operation, transfer characteristics, lock range and capture range. Applications of PLL as frequency multiplier, FM demodulation, frequency synthesizer etc., study of one PLLIC.

Power Electronics

10. **Rectifiers and Regulators.** Polyphase rectifiers with resistive load, ripple factor considerations, series and shunt regulators, crowbar protection circuit, over load/over voltage protection, principle of switching mode regulators, study of regulators ICs such as CA 723, 3085 and IC 317, 3-terminal ICs and their circuits. Dual tracking power supply.

11. **Inverters and Converters.** Principle of inverters, bridge inverters, PWM inverters methods to improve O/P of inverter and principle of choppers. Study of UPS. Principle of cycloconverters with PWM control. Applications of the power devices.
12. **DC Drivers.** Introduction, merits and demerits, fields of applications, basic characteristics of DC motors, constant torque and constant HP operation, speed control and regulation of DC motors using armature voltage control. IR drop compensation, armature current limiting single phase drives using half wave converters, full and dual converters, use of chopper drives, close loop control of DC drives, microcomputer control of DC drivers, PWM devices, speed control of DC series motor and current control of DC drives.

Linear Integrated Circuits

13. **On-Amp Application.** Bridge amplifier, instrumentation, amplifier, multiplier and divide circuits, sample and hold circuits and audio power amplifier.
14. **Frequency Compensation.** Integrator, differentiator, frequency compensation techniques, OP-AMP transfer function, bode plot, gain margin, phase margin and frequency compensation for integrator/differentiator with practical circuits.
15. **Active Filters.** Highpass, Lowpass, bandpass, notch, butter worth filters, first order and second order filters.

Applied Electronics

16. **Transistorised Switching Circuits.** On-Off switching times, hold/storage multi-vibrators, Bistable Monostable, astable circuit operation, wave forms and applications, Schmitt trigger, Circuit, operation, wave forms and fields of applications.
17. **Wave Shaping Circuit.** Meaning and need of wave shaping circuit linear wave shaping Circuit, differentiator integrator, their outputs for different inputs and different time constants, non-linear wave shaping circuits, diode and transistor clippers and diode clampers.
18. **Waveform Generators.** Sinusoidal oscillators, LC/RC oscillators, Square wave generators, triangular wave and miller integrator. Construction, operation, characteristics, applications and specifications of UJT.
19. **Pulse Amplifier.** Rise time, requirements of pulse amplifier, compensating methods. Wide band amplifier using BJT and study of response to square wave.

Industrial Electronics

20. **Electronic Time Delay Relays.** DC & AC time delay relays using SCRs UJT and timer circuit.
21. **Power and Photo Devices.** Constructions, symbols, operating principle, characteristics and ratings of DIAC, TRIAC, PUT, SUS, SBS, SCS, IGBT, GTO and power MOS. Photo emission/photo conduction principle and devices using this principles such as photodiode, phototransistor, LDR, photo voltaic cell, solar cell and opto coupler.
22. **Industrial Circuits.** Power control using TRIAC, fan regulator light dimmer, static circuit, breaker time delay circuits, zero voltage switch, DC flasher with adjustable ON-OFF time, burglar alarm and smoke detector.

Microprocessor Interfacing Techniques

23. **Parallel Input/Output and Interfacing Applications.** Basic interfacing concept, peripheral I/O instructions, I/O execution, device selection and data transfer, interfacing I/O using decoders, memory mapped I/O interfacing and memory bus contention.
24. **Interrupts.** 8085 interrupts, implementation of interrupts, TRAP, RST 7.5, 6.5 and 5.5. programmable interrupt controller 8259A.
25. **Interfacing Data Converters.** Digital to analog converter, interfacing 8-bit D/A converter with 8085 microprocessor, compatible D/A converters. Analog to digital converters, software controlled A/D converter, interfacing 8-bit A/D converter using status check/wait states and interrupt.
26. **Programmable Interface Devices.** Interfacing 8212, 8155, 8253, 8255, 8279 and 8257 with 8085 processor.
27. **Serial I/O Data communication.** Basic concept in serial I/O, I/O requirement, transmission format, SIMPLEX/DUPLEX transmission, MODEM, RS-232 and software approach for serial I/O. error detection and error correction techniques.

Optical Fibre Communication

28. **Fibre Optical Source/Devices.** Types of optical sources, operating principle, Snell's law, Dispersion, Advantages and application of Fibre optics in Communication and structures of LED and Laser devices.

29. **Manufacturing of Fibres and Cables.** Cables, splices, connectors and comparison between optical fibre and conventional electrical transmission line.
30. **Fibre Types.** Ray theory of transmission, types of fibres, step index, graded index and propagation of light through fibre.

Study Material

- (a) Electronic Principle by Malvino
- (b) Microprocessors by Mathur
- (c) Digital Electronics by Tokheim
- (d) Electronic Components and materials by Joshi

BASIC ELECTRONICS

1. **Introduction.** Electronics, atomic structure of elements, valance electrons, free electron, types of electron emission, semi conductor physics.
2. **Semiconductor Diode.** P-N Junction diode, construction, working under forward and reverse bias condition, diode characteristics, barrier potential rectifiers, half wave and full waver rectifiers (bridge and centre tap), comparison of different rectifiers, filters, capacitor filter, pi filter and their advantages and comparisons. Zener diodes and their characteristics, construction and operation.
3. **Transistors.** Principle of operation of transistors, transistor action, switch, different transistor configurations(CB, CE, CC), transistor as an amplifier, transistor audio power amplifier, types class A, B,AB and their comparison and low frequency model of transistor.
4. **Feed back Amplifiers.** Types of feed back and comparison of negative with positive feed back concept of negative feed back, effect of feed back on different circuits, parameters like voltage and current. Tickler feed back oscillator, Hartley oscillator, colpitt oscillator, Phase shift oscillator.
5. **Multistage Amplifiers.** R-C coupled amplifiers, transformer coupled amplifiers, direct coupled amplifiers, advantages and comparison of different types of coupling.
6. **Field Effect Transistors.** Working principle of JFET, characteristics, symbols, difference between FET and BJT, FET biasing, relation between FET parameters, working principle of MOSFET and FET as an amplifier.

7. **Turned Amplifiers**. Concept of turned amplifiers, frequency response, band width single turned amplifiers, double turned amplifiers and staggered turned amplifiers.
 8. **Number Systems and Codes**. Introduction to number systems, decimal, hexadecimal code, other code conversions, Binary addition, subtraction, multiplication, division, DCB additions, 1's and 2's complement.
 9. **Boolean Algebra**. Basic laws, D'Morgan's theorem, k-map techniques (upto 4 variables) sum of product and product of sum conversions.
 10. **Digital Logic Families**. Study of IC 7400,7302,7404,7408,7432 and 7486. logic families i.e., TTL, ECL, CMOS etc. multivibrators using logic gates (astable, monostable and bistable). Introduction to SSI, MSI, LSI and VLSI.
 11. **Sequential logic Design**. R-S, J-K, Masters slave, shift registers, counters, Mod 'N' counters, Up-down counters, divide by N-counters, ring counters and shift counters and ripple counters.
 12. **Combinational Logic Design Using MSI Circuits**. Half adder, full adder, 4-bit binary adder, half subtractor, full subtractor, addition, subtraction using 2's complement, BCD adder and digital comparators.
 13. **Encoders and Decoders**. Multiplexers and demultiplexers, 1:8 line, 1:16 line and 8:1 line, BCD to binary and binary to BCD decoders, bi-directional buffers parity generators, encoders and decoders.
 14. **Converters**. A/D and D/A converters, single slope, dual slope successive approximation method, stair case, ramp, R-2R ladder and study of ADC chips.
 15. **Electronic Materials & Components**
 16. **Transistors**. Fabrication techniques, alloy processes, epitaxial, planer and other types of transistors. Fabrication techniques, specifications, testing and applications of JEET and MOSFET.
 17. **Transformers**. Types – power, auto, variable and line transformer with construction, specification, testing and applications of each.
- Introduction to Microprocessors**
18. **Introduction**. Digital computers, computers languages (a brief idea), basic computer organization, function, of CPU, memory and I/O devices.
 19. **Microprocessors Architecture**. Microprocessor architecture and its operations, memory, example of micro computer system, registers, buffer etc.

20. **Microcomputer System.** 8085 MPU, 8086 MPU and examples of microcomputer systems. Decoders, latches, address decoding, memory interfacing input/output decoding of 8085, stacks and subroutines.

Linear Integrated Circuits

21. **Basic OP-Amp Circuits.** Open loop configuration, closed loop configuration, inverting, non inverting, unity gain, adder scaling adder, subtractor, protection circuits, supply reversal, protection, input impedance and output impedance.

22. **Rectifiers.** Half wave rectifier, full wave rectifier, precision rectifier, log amplifier and Antilog.

23. **Operational Amplifiers.** Basic concepts of OP-AMP, block diagram of OP-AMP measurement of OP-AMP parameters and methods to improve CMRR.

24. **Comparators.** Basic operation, inverting and non-inverting configuration, comparator, voltage limited, zero crossing detector, Schmitt trigger, peak detector, peak to peak detector, window detector and interfacing the comparators.

Applied Electronics

25. **FETs and their Applications.** Construction, principle of operations, types characteristics and biasing. FET as variable resistors. FET parameters, advantages and applications of FET. Working principle of MOSFET and its applications.

26. **Feedback Amplifier.** Negative feedback in amplifiers and their typical circuits.

Industrial Electronics

27. **Thyristors.** V-I characteristics, thyristor ratings, anode voltage/current ratings, gate ratings, dv/dt and di/dt rating, methods of turning on the thyristor with and without gate, thyristor protection circuits and snubber circuits with R-L loads – commutation of SCRs.

28. **Multiple Connections of SCR.** Series and parallel operation of SCRs and triggering of Series/parallel connected SCRs.

Optical Fibre Communication

29. **Photo Devices.** Theory and characteristics of photo diode, design and construction of photo transistor, symbolic representation, basic amplifier and other applications.
30. **Optical Detectors.** Construction and working of PN junction photo diode, avalanche photo diode and semi conductor PIN photo diode detectors.
31. **Opto Isolators.** Theory of opto isolators, photo emitter, optical medium and analog applications of optically coupled isolator and digital applications.

Computer Technology.

32. **Introduction to Computers.**
1. **Windows Operating System and Common Software Packages.**
Introduction to Windows, MS Word, Power Point and Excel Software Packages.

Study Material.

- (a) Electronics (set of 7 volumes) by Henry Mileaf.
- (b) Electronic Principles by Malvino
- (c) Digital Electronics by Yokheim

Part B

(b) SYLLABUS FOR TRADE TESTING EXAMINATION OF RADIO / RADAR

1. The Candidates appearing in the respective trade test for promotion to Foreman (Radio/Radar), Assistant Foreman (Radio/Radar), Chargeman – Gde I (Radio/Radar) and Chargeman – Gde II (Radio/Radar) will be examined in:

- (a) Basic Electrical Engineering
- (b) Electrical Technology
- (c) Basic Electronics
- (d) Information Technology
- (e) Radio/Radar theory

2. The trade test syllabi will be common for all Supervisory Grades of Radio/Radar Trade. However the level/depth of knowledge differs for each grade. At higher grades the knowledge on practical applications should be in-depth and in theory the same may be superficial. Similarly at lower grades the knowledge on practical applications may be superficial, however the theoretical knowledge should be in-depth.

Foreman (Radio/Radar)

3. The Foreman (Radio/Radar) is expected to possess adequate knowledge in Basic Electrical Engineering, Electrical Technology including circuit theory and vector representation of electrical quantities, Basic Electronics and Information Technology. In addition the Foreman (Radio/Radar) should possess in depth knowledge in Radio/Radar theory.

Assistant Foreman (Radio/Radar)

4. The Assistant (Radio/Radar) is expected to possess in depth knowledge in Basic Electrical Engineering, Electrical Technology including circuit theory and vector representation of electrical quantities, Basic Electronics, Information Technology as well as Radio/Radar theory.

Chargeman – Gde I (Radio/Radar)

5. The Ch~~ar~~geman – Gde I (Radio/Radar) is expected to possess in depth knowledge in Basic Electrical Engineering, Electrical Technology including circuit theory and vector representation of electrical quantities, Basic Electronics, Information Technology and Radio/Radar theory.

The Syllabus

6. The Syllabus to be covered from the above mentioned subjects for the above three Supervisory Grades of Radio/Radar Trade are appended below.

- (a) **Basic Electrical Engineering.**

- (i) **Units and dimensions.** Factors determining resistance of a conductor, dependence on temperature, colour code, Units and Calculations.
- (ii) **Electro Magnetism.** Magnetic fields due to current carrying conductors, solenoids etc., Magnetising force, flux density, Permeability and B/H curve. I.H.Curves The magnetic circuit, M.M.F and Reluctance. Effect of air gap Induced EMF, Faraday's and Lenz's Laws. Self-induction and Mutual induction, Hysterisis and eddy current losses; Units and calculations.
- (iii) **Basic Electronics**
 - (iv) **Semi-Conductors and its Characteristics, Transistor theory.**
 - (v) **Integrated Circuits**
- (vi) **Information (Digital) Technology**
 - (vii) **Radio Basics.** Resistors at high frequencies. Skin effect. Non-inductive resistors co-efficient of coupling. Temperature coefficient electric and magnetic shielding series and parallel resonance. Resonant frequency. Time constant. Q types of coupled circuits, band pass. General outline of filter theory. Simple LC filters. High and low pass filters. Cut off frequencies. Band pass and Band stop filters. Matching and improving cut off. Attenuation. Characteristics impedance.
Radio Theory. Gain Vs Band width, consideration of amplifiers in cascades, Neutralisation, Frequency Multipliers, Temperature controlled master oscillators, Balanced Modulator, Peedex lines, matching, Reflection and heating due to mismatch. Discriminators-Pester ceely discriminator, phase and Frequency modulation.
 - (viii) **Radar Basics.** Radar equation transmitter power. Bandwidth needed in receivers. Frequencies used. Significance of parameters. Differentiation and integration. Square and saw tooth inputs. Biased differentiation. Clamping and limiting. Video amplifier. Wide band power amplifier. Transient response of amplifiers. Square wave generators. Relaxation oscillators. Multi-vibrators. Counting down. Cathodes flip-flop. Transition. Time bases. CR Time base. Constant current time base. Miller PPI and other time bases. Expanded time base. Strobng. Range transmission unit, phase shift oscillator. Calibrators – ringing circuits. Crystal calibrator firing circuits. Blocking oscillator. Fire ranging principles. Resonant cavities. Reflex klystron. Typical klystrons, tuning A.P.C. swept gain. Logarithmic amplifiers. Magnetron, strapping, basic tuning drill. Pre-plumbed magnetron.
Transmission lines principles. Reflection. Standing waves. Nodes and anti nodes, S.W.R stub matching. Discharge line modulator circuits using thyatron, trigatron spart gap.Wave guides T & R switches. Crystal mixers.

- (ix) **Electrostatics.** Electric field between parallel plates, Electric Force, capacitance; Types of capacitance. Units and calculations.

(b) **Electrical Technology.**

- (i) **Circuit theory.** Three circuit elements (Resistance, inductance and capacitance) Ohm's Law and Kirchoff's Laws. Solution of series and parallel networks. Power in circuits, Power factor. Two and three phase supplies; Star and Delta connections. Relation between line and phase values. Sine effect calculations/vector representations.
- (ii) **Measuring Instruments.** Basic principles of Moving Coil, Moving iron, Electrostatic meters, ammeters, Voltmeters, Ohmmeters, Meggers, Multimeters etc. and all Digital Meters.
- (iii) **Electrical Workshop Practice:** Knowledge of use and maintenance of general hand tools, gauge, instruments like Voltmeter, Ammeter, Wattmeter (ac & d.c) Power Factor meter, Phase sequence Indicator/Synchro scope, Multimeter H.T Cable testers, Time of operation test set, primary and secondary current.

(c) **Rectifiers.**

Various types. Peak inverse voltages. Voltage ratio voltage multipliers. Vibrators. Voltage regulation by vein tube. Half and full wave. Bridge circuits. Ripple factor. Filter, Phase sensitive rectification. Voltage stabilizers, Photo electric cells and tubes.

(d) **Amplifiers.**

Classification, A.F. amplification. equivalent circuit. R.C coupled amplifier. Gain and frequency response, frequency response on Bias methods. Transformer coupling. D.C. amplifiers. Power amplifiers. Distortion and harmonics. Push pull amplifiers. Advantages, feed back amplifiers. Types of feed back. Effect amplifiers. Effect on gain distortion phase, frequency response and internal impedance. Gain and tone controls. Cathode invertors. Operational amplifiers, Long-tailed pair. Magnetic amplifiers. RF amplifiers. Tuned loads and types of RF coupling and their frequency response. Band pass amplifiers. Miller effect. Neutralisation A.G.C. I.F. amplifiers, VHF and UHF amplifiers coupling systems. Transit time. Logarithmic amplifier.

(e) **Oscillators**

Simple valve oscillator. Conditions of starting and maintenance of oscillations. Bias and H.T. supplies for an oscillator. Block squigging. Coupling to load. Frequency stability. Effects of variation of load, voltage and coupling on frequency phase and aptitude. Hartely, colpi inverted

types tuned anode, tuned grid, electron coupled electron and frau oscillators. Amplitude control, wave shape, B.F.O. R.C. oscillator. Prasi oscillations and its elimination. UHF oscillators. Valves used. Special features of circuits and components. Frequency drift. Master oscillator buffer stage A.F.C piezo electric effect. Crystal oscillators. Mountings. Frequency standard. Frequency multipliers. Partial crystal control.

(f) **Modulation**

(i) ***Amplitude modulation.*** Principles. Different methods of amplitude modulation. Depth of modulation. Side bands. Power content. Anode grid suppressor and screen modulation. Metallic modulators carrier suppression. Balanced modulators.

(ii) ***Frequency and phase modulation.*** Side bands, frequency spectrum choice of frequency. Advantages and disadvantages, Cross modulation, Wide and narrow band F.M. reactance modulator. Detection. Limitations, Phase conscious circuits. Discrimination.

(g) **Demodulation.**

Diode detectors. Filtering and blocking of unwanted components. Special methods of handling strong and weak signals. Crystal and metallic detectors.

(h) **AM and FM transmitters and receivers.**

Super heterodyne receivers. Double superheat receivers. Sensitivity. Selectivity fidelity, stability and noise of receivers, choice of I.F, for H.F., VHF and UHF receivers. Alignment of receivers. SSB Transmitters and receivers. Jamming and anti jamming devices.

(j) **Current and voltage distribution**

Radiation impedance. Dipoles field strength. Polar diagram. Radiated energy and radiation resistance effective height. Electrical length. Serial losses. Input resistance and reactance tuning—aerial feed system. Wide hand aerials. Long wire aerials. V aerials. Phombic aerials. Receiving aerials and principles of common aerial working.

(k) **Propagation**

Reflection, Sky wave, skip distance. Propagation characteristics.

(l) **Noise**

Classification and measurement.

(m) Direction finding

Errors in D.F. at MF, HF and VHF.

(n) ***Calibration of D.F. Sets.***

(p) ***Aerials.*** Elements of aerial system. Resonant and non-resonant aerials. Common aerial working. Conical scanning, beam switching.

- (q) **Cathode Ray tubes.** Electron gun. Focusing. Electromagnetic and Electrostatic deflection. Simple time bases. Double beam tubes. Power supplies. Penta house waveform.
- (r) **Displays—various types.** PPI Brightening. Fixed scanning coils, sector selection, explanation and tracing of a typical display circuit. Automatic centering. Projection of own movement. Raster Scan, LCD, Plasma Display etc.,
- (s) **W/T Sets and Test equipment.** Pre-refit trials, repairs, overhaul stage inspection, quality control, final inspection, subassembly and major unit testing . Also setting to work after installation on board ship.
- (t) **W/T sets. Receiver outfits.**

(u) Search Receivers QR/QS. Receivers. Signal generators. Test Oscillators. Pulse generators.

- (v) **Impedance Bridges.** Test set receiver and hot set performance. Calibrator range indicators. S.W.R. Indicators high resistance meters. Variable attenuators. Test set insulation . Electronic Voltmeter and Multimeter . Test set electronic valve and test set transistors. Frequency counters and wave meters and transistorised types Freq Meters. Test Set telegraph and test set telegraph distortion. Meter noise level. Magslip alignment test set. Voltage Measuring unit. Watt Meter description. Decibel Meters and test set Radio. Strobo flash. Pen Recorders and pen recorder amplifiers. Magslip filter detectors.
- (w) **Radar Sets.** Pre-refit trials, repairs overhaul, stage inspection, quality control, final inspection, subassembly and major unit testing as per specifications of following equipment. Also setting to work after installation on board ship. Post refit and harbour acceptance trials.
- (x) **IFF Sets.** Navigation sets. Warning Sets. Carrier Control approach. Gunnery Radar sets.
- (y) **Oscilloscopes.** Use of double beam oscilloscopes
- (z) Theory of L/P Sets, M.F, H.F, VHF. Alignment of L.F sets. Nav aids
- (aa) Tracing and alignment of receivers and UHF sets. Critically maintaining dimensions of components and leads at VHF and UHF. Use of proper tracking tools. Capacitance effect of using non standard tools, Importance of using screened leads. Proper earthing.
- (bb) **Test Equipment.** Principle of working and use of following test equipment. Valve voltmeter, Electrostatic Voltmeter. Universal AVO meter. Multimeter. Avometers. Wave meters. FM deviation Test set. Test set Radio Oscilloscope. Signal Generators. Test set oscillator and distortion meter. Wee Meggers. Q Meter. Impedance Bridge. SWR indicators. Frequency response Test set. Portable performance Test set. Noise level Meters. Absorption Wattmeter. Decibel Meters.
- (cc) **Drawing and Specifications.**

- = Should be able to draw and understand circuits used in radio receivers and Transmitters
- = Should be able to draw simple sketches to explain constructional details of equipment
- = Should be able to read and understand and explain technical details from BRs , specification, Hand books, E lists, Installation Specifications.

Chargeman Gde-II (Radio)

7. The trade test syllabi for Chargeman Gde-II (Radio) is appended below. The Chargeman Gde-II (Radio) is expected to possess adequate knowledge in Basic Electrical Engineering, Electrical Technology, Basic Electronics, Information Technology, Radio theory and basic knowledge in Radar principles and Theory.

(a) **Basic Electrical Engineering.**

- (i) ***Units and dimensions.*** Factors determining resistance of a conductor, dependence on temperature, colour code, Units and Calculations.
- (ii) ***Electro Magnetism.*** Magnetic fields due to current carrying conductors, solenoids etc., Magnetising force, flux density, the magnetic circuit, M.M.F and Reluctance. Induced EMF, Faraday's and Lenz's Laws. Units and Calculations.
- (iii) ***Electrostatics.*** Electric field between parallel plates, Electric Force, capacitance; Types of capacitance, *Units* and Calculations.

(iv) ***Basic Electronics***

(v) ***Semi-Conductors and its Characteristics, Transistor theory.***

- (vi) ***Integrated Circuits***
- (vii) ***Information (Digital) Technology***

(b) **Electrical Technology.**

- (i) ***Circuit theory.*** Three circuit elements (Resistance, inductance and capacitance) Ohm's Law and Kirchoff's Laws. Solution of series and parallel networks. Power in circuits, Power factor. Two and three phase supplies; Star and Delta connections. Relation between line and phase values. Sine effect calculations/vector representations.
- (ii) ***Measuring Instruments.*** Basic principles of Moving Coil, Moving iron, Electrostatic meters, ammeters, Voltmeters, Ohmmeters, Meggers, Multimeters and all Digital Meters.

- (iii) **Electrical Workshop Practice:** Knowledge of use and maintenance of general hand tools, gauge, instruments like Voltmeter, Ammeter, Wattmeter (ac & d.c) Power Factor meter, Phase sequence Indicator/Synchro scope, Multimeter H.T Cable testers, Time of operation test set, primary and secondary current. Carbon Pile Regulators, cinema projectors, recording outfits.

(c) **Radio Theory**

Radio Basics. Resistors at high frequencies. Non-inductive resistors, co-efficient of coupling. Temperature coefficient electric and magnetic shielding, series and parallel resonance. Resonant frequency. Time constant. Q types of coupled circuits, band pass. General outline of filter theory. Simple LC filters. High and low pass filters. Cut off frequencies. Band pass and Band stop filters. Matching and improving cut off. Attenuation. Characteristics impedance.

Radio Theory. Gain Vs Band width, consideration of amplifiers in cascades, Neutralisation, Frequency Multipliers, Temperature controlled master oscillators, Balanced Modulator, Peedex lines, matching, Reflection and heating due to mismatch. Discriminators-Pester ceely discriminator, phase and Frequency modulation. Impedance Bridges.

Test set receiver and hot set performance. Calibrator range indicators. S.W.R. Indicators high resistance meters. Variable attenuators. Test set insulation . Electronic Multimeter and voltmeter . Test set electronic valve and test set transistors. Frequency counters and wave meters and transistorised types Freq Meters. Test Set telegraph and test set telegraph distortion. Meter noise level. Magslip alignment test set. Voltage Measuring unit. Watt Meter description. Decibel Meters and test set Radio. Strobo flash. Pen Recorders and pen recorder amplifiers. Magslip filter detectors. Radio interference, suppressors, and distortion fading. Etc.

(d) **Radar Theory**

Radar Basics. Radar equation transmitter power. Bandwidth needed in receivers. Frequencies used. Significance of parameters. Differentiation and integration. Square and saw tooth inputs. Biased differentiation. Clamping and limiting. Video amplifier. Wide band power amplifier. Transient response of amplifiers. Square wave generators. Relaxation oscillators. Multi-vibrators. Counting down. Cathodes flip-flop. Transition. Time bases. CR Time base. Constant current time base. Miller PPI and other time bases. Expanded time base. Strobng. Range transmission unit, phase shift oscillator. Calibrators – ringing circuits. Crystal calibrator firing circuits. Blocking oscillator. Fire ranging principles. Resonant cavities. Reflex klystron. Typical klystrons, tuning A.P.C. swept gain. Logarithmic amplifiers. Magnetron, strapping, basic tuning drill. Pre-plumbed magnetron. Transmission lines principles. Reflection. Standing waves. Nodes and anti nodes, S.W.R stub matching. Discharge line modulator circuits using thyatron, trigatron spart gap. Wave guides T & R switches. Crystal mixers.

Radar Theory. Chief features of Radar Set. Pulse length, PRF, Pulse shape radio frequency, serial rotation speed. Transitory. Strobging and Ranging circuits strobe generators, fire ranging principles, phantasone, Miller integrator, R.C. phase shift oscillator, Delay and pulse shaping wires. Turned circuits at VHF and UHF tuned lines, cavity resonators, coupling methods. Transmitters: Trigger using differentiation and ringing Modulators using thyatron or spark gap. Double discharge lines. Resonant changing. Gunnery Radar Transmitters and Receivers. Wave guides: Joints, bends, irises, stub matching reflection SWR coaxial feeders. Conical scanning. Radar Receivers, Grounded grid triode, Diode mixes, crystal mixes, directional coupling, reflex klystron, AFC IF stages, second detector, gain control, swept gain, logarithmic amplifier, video signal processing, noise factor, anti-jamming measures. AGO. Beam Switches. Gain Vs Band width, consideration of amplifiers in cascades, Neutralisation, Frequency Multipliers, Temperature controlled master oscillators, Balanced Modulator, Peedex lines, matching, Reflection and heating due to mismatch. Discriminators-Pester ceely discriminator, phase and Frequency modulation.

(e) **Rectifiers.**

Various types. Peak inverse voltages. Voltage ratio voltage multipliers. Vibrators. Voltage regulation by vein tube. Half and full wave. Bridge circuits. Ripple factor. Filter, Phase sensitive rectification. Voltage stabilizers, Sof diode and thyratrons-characteristics. Cold tubes. Photo electric cells and tubes.

(f) **Amplifiers.**

Classification, A.F. amplification.. equivalent circuit. R.C coupled amplifier. Gain and frequency response, frequency response on Bias methods. Transformer coupling. D.C. amplifiers. Power amplifiers. Distortion and harmonies. Push pull amplifiers. Advantages, feed back amplifiers. Types of feed back. Effect amplifiers. Types of feed back. Effect on gain distortion phase, frequency response and internal impedance. Gain and tone controls. Cathode invertors. Operational amplifiers, Long-tained pair. Magnetic amplifiers. RF amplifiers. Tuned loads and types of RF coupling and their frequency response. Band pass amplifiers. Miller effect. Neutralisation A.G.C. I.F. amplifiers, VHF and UHF amplifiers coupling systems. Transit time. Logarithmic amplifier.

(g) **Oscillators**

Conditions of starting and maintenance of oscillations. Bias and H.T. supplies for an oscillator. Block squiggling. Coupling to load. Frequency stability. Efforts of variation of load, voltage and coupling on frequency phase and aptitude. Hartely, colpi inverted types tuned anode, tuned grid, electron coupled electron and frau oscillators. Amplitude control, wave shape, B.F.O. R.C. oscillator. Prasi oscillations and its

elimination. UHF oscillators. Special features of circuits and components. Frequency drift. Master oscillator buffer stage A.F.C piezo electric effect. Crystal oscillators. Mountings. Frequency standard. Frequency multipliers. Partial crystal control.

(h) **Modulation**

(i) ***Amplitude modulation.*** Principles. Different methods of amplitude modulation. Depth of modulation. Side bands. Power content. Anode grid suppressor and screen modulation. Metallic modulators carrier suppression. Balanced modulators.

(ii) ***Frequency and phase modulation.*** **Frequency Modulation. Knowledge of frequency and phase modulated transmitters and receivers. Side bands, frequency spectrum choice of frequency. Advantages and disadvantages, Cross modulation, Wide and narrow band F.M. reactance tubes. Detection. Limitations, Phase conscious circuits. Discrimination.**

(j) **Demodulation.**

Diode detectors. Filtering and blocking of unwanted components. Special methods of handling strong and weak signals. Crystal and metallic detectors.

(k) **AM and FM transmitters and receivers.**

Transmitters. Theory of transmitter, master oscillators, crystal oscillators power amplification, amplitude modulation. Receivers. MF, HF, receivers Super heterodyne receivers. Double superheat receivers. Sensitivity. Selectivity, fidelity, stability and noise of receivers, choice of I.F, for H.F., VHF and UHF receivers. Alignment of receivers. SSB Transmitters and receivers. Jamming and anti jamming devices. faultfinding and repair. Shore Wireless Sets. Fault finding and repairs. Voice Control Outfits. Working and repairs.

(l) **Current and voltage distribution**

Radiation impedance. Dipoles field strength. Polar diagram. Radiated energy and radiation resistance effective height. Electrical length. Serial losses. Input resistance and reactance tuning—aerial feed system. Wide hand aerials. Long wire aerials. V aerials. Phombic aerials. Receiving aerials and principles of common aerial working.

(m) **Propagation**

Reflection, Sky wave, skip distance. Propagation characteristics.

(n) **Noise**

Classification and measurement.

(p) Direction finding

DF sets. Theory of MF, HF Direction findings sets and their calibration fault finding and Repairs. Calibration of D.F. Sets. Errors in D.F. at MF, HF and VHF.

- (q) **Aerials.** Elements of aerial system. Resonant and non-resonant aerials. Common aerial working. Conical scanning, beam switching.
- (r) **Cathode Ray tubes.** Electrostatic and Electro magnetic CRT. Electron gun. Focusing. Electromagnetic and Electrostatic deflection. Simple time bases. Double beam tubes. Power supplies. Penta house waveform.
- (s) **Displays—various types.** PPI Brightening. Fixed scanning coils, sector selection, explanation and tracing of a typical display circuit. Automatic centring. Projection of own movement. Time Bases for Displays. CR time bases, Miller Time Base. Raster Scan, LCD, Plasma Display etc.,
- (t) **W/T Sets and Test equipment.** Receiver outfits. Pre-refit trials, repairs, overhaul stage inspection, quality control, final inspection, subassembly and major unit testing as per specifications, of following equipment. Also setting to work after installation on board ship.
- (u) Search Receivers QR/QS. Receivers. DF Outfits. Eecca Navigation sets. Battery outfits. Test equipment. Cathode ray oscilloscopes and wave monitors. Signal generators .Test Oscillators. Pulse generators.
- (v) **Impedance Bridges.** Test set receiver and hot set performance. Calibrator range indicators. S.W.R. Indicators high resistance meters. Variable attenuators. Test set insulation . Electronic Multimeter and voltmeter . Test set electronic valve and test set transistors. Frequency counters and wave meters and transistorised types Freq Meters. Test Set telegraph and test set telegraph distortion. Meter noise level. Magslip alignment test set. Voltage measuring unit. Watt Meter description. Decibel Meters and test set Radio. Strobo flash. Pen Recorders and pen recorder amplifiers. Magslip filter detectors.
- (w) **Radio Sets.** Pre-refit trials, repairs overhaul, stage inspection, quality control, final inspection, subassembly and major unit testing as per specifications of following equipment. Also setting to work after installation on board ship. Post refit and harbour acceptance trials.**Aerials.** Common aerial working. Conical scanning, beam switching. Resonant and non-resonant aerials.
- (x) **Oscilloscopes.** Use of double beam oscilloscopes
- (y) Theory of L/P Sets, M.F, H.F, VHF. Alignment of L.F sets. Nav aids
- (z) Tracing and alignment of receivers and UHF sets. Critically maintaining dimensions of components and leads at VHF and UHF. Use of proper tracking tools. Capacitance effect of using non-standard tools, Importance of using screened leads. Proper earthing.
- (aa) **Test Equipment.** Principle of working and use of following test equipment. Valve voltmeter, Electrostatic Voltmeter. Universal AVO meter. Multimeter.

Avometers. Wave meters. FM deviation Test set. Test set Radio Oscilloscope. Signal Generators. Test set oscillator and distortion meter. Wee Meggers. Q Meter. Impedance Bridge. SWR indicators. Frequency response Test set. Portable performance Test set. Noise level Meters. Absorption Wattmeter. Decibel Meters.

(bb) ***Drawing and Specifications.***

- = Should be able to draw and understand circuits used in radio receivers and Transmitters
- = Should be able to draw simple sketches to explain constructional details of equipment
- = Should be able to read and understand and explain technical details from BRs , specification, Hand books, E lists, Installation Specifications.

Chargeman Gde-II (Radar)

8. The trade test syllabi for Chargeman Gde-II (Radar) is appended below. The Chargeman Gde-II (Radar) is expected to possess adequate knowledge in Basic Electrical Engineering, Electrical Technology, Basic Electronics, Radar theory and basic knowledge in Radio principles and Theory.

(a) **Basics of Electrical Engineering.**

- (i) ***Units and dimensions.*** Factors determining resistance of a conductor, dependence on temperature, colour code, Units and Calculations.
- (ii) ***Electro Magnetism.*** Magnetic fields due to current carrying conductors, solenoids etc., Magnetising force, flux density, The magnetic circuit, M.M.F and Reluctance. Induced EMF, Faraday's and Lenz's Laws. Units and Calculations.
- (iii) ***Electrostatics.*** Electric field between parallel plates, Electric Force, capacitance; Types of capacitance, Units and Calculations.

(iv) ***Basic Electronics***

(v) ***Semi-Conductors and its Characteristics, Transistor theory.***

- (vi) ***Integrated Circuits***
- (vii) ***Information (Digital) Technology***

(b) **Electrical Technology.**

- (i) ***Circuit theory.*** Three circuit elements (Resistance, inductance and capacitance) Ohm's Law and Kirchoff's Laws. Solution of series and parallel networks. Power in circuits, Power factor. Two

and three phase supplies; Star and Delta connections. Relation between line and phase values. Sine effect calculations/vector representations.

- (ii) **Measuring Instruments.** Basic principles of Moving Coil, Moving iron, Electrostatic meters, ammeters, Voltmeters, Ohmmeters, Meggers, Multimeters etc and all Digital Meters.
- (iii) **Electrical Workshop Practice:** Knowledge of use and maintenance of general hand tools, gauge, instruments like Voltmeter, Ammeter, Wattmeter (ac & d.c) Power Factor meter, Phase sequence Indicator/Snychro scope, Multimeter H.T Cable testers, Time of operation test set, primary and secondary current. Carbon Pile Regulators, cinema projectors, recording outfits.

(c) **Radio Theory**

Radio Basics. Resistors at high frequencies. Non-inductive resistors, coefficient of coupling. Temperature coefficient electric and magnetic shielding, series and parallel resonance. Resonant frequency. Time constant. Q types of coupled circuits, band pass. General outline of filter theory. Simple LC filters. High and low pass filters. Cut off frequencies. Band pass and Band stop filters. Matching and improving cut off. Attenuation. Characteristics impedance.

Radio Theory. Gain Vs Band width, consideration of amplifiers in cascades, Neutralisation, Frequency Multipliers, Temperature controlled master oscillators, Balanced Modulator, Peedex lines, matching, Reflection and heating due to mismatch. Discriminators-Pester ceely discriminator, phase and Frequency modulation. Impedance Bridges.

Test set receiver and hot set performance. Calibrator range indicators. S.W.R. Indicators high resistance meters. Variable attenuators. Test set insulation . Electronic Multimeter and voltmeter . Test set electronic valve and test set transistors. Frequency counters and wave meters and transistorised types Freq Meters. Test Set telegraph and test set telegraph distortion. Meter noise level. Magslip alignment test set. Voltage Measuring unit. Watt Meter description. Decibel Meters and test set Radio. Strobo flash. Pen Recorders and pen recorder amplifiers. Magslip filter detectors. Radio interference, suppressors, and distortion fading. Etc.

(d) **Radar Theory**

Radar Basics. Radar equation transmitter power. Bandwidth needed in receivers. Frequencies used. Significance of parameters. Differentiation and integration. Square and saw tooth inputs. Biased differentiation. Clamping and limiting. Video amplifier. Wide band power amplifier. Transient response of amplifiers. Square wave generators. Relaxation oscillators. Multi-vibrators. Counting down. Cathodes flip-flop. Transition. Time bases. CR Time base. Constant current time base. Miller PPI and other time bases. Expanded time base. Strobing. Range transmission unit, phase shift

oscillator. Calibrators – ringing circuits. Crystal calibrator firing circuits. Blocking oscillator. Fire ranging principles. Resonant cavities. Reflex klystron. Typical klystrons, tuning A.P.C. swept gain. Logarithmic amplifiers. Magnetron, strapping, basic tuning drill. Pre-plumbed magnetron. Transmission lines principles. Reflection. Standing waves. Nodes and anti nodes, S.W.R stub matching. Discharge line modulator circuits using thyatron, trigatron spart gap. Wave guides T & R switches. Crystal mixers.

Radar Theory. Chief features of Radar Set. Pulse length, PRF, Pulse shape radio frequency, serial rotation speed. Transitron. Stroboging and Ranging circuits strobe generators, fire ranging principles, phantasone, Miller integrator, R.C. phase shift oscillator, Delay and pulse shaping wires. Turned circuits at VHF and UHF tuned lines, cavity resonators, coupling methods. Transmitters: Trigger using differentiation and ringing Modulators using thyatron or spark gap. Double discharge lines. Resonant changing. Gunnery Radar Transmitters and Receivers. Wave guides: Joints, bends, irises, stub matching reflection SWR coaxial feeders. Conical scanning. Radar Receivers, Grounded grid triode, Diode mixes, crystal mixes, directional coupling, reflex klystron, AFC IF stages, second detector, gain control, swept gain, logarithmic amplifier, video signal processing, noise factor, anti-jamming measures. AGO. Beam Switches. Gain Vs Band width, consideration of amplifiers in cascades, Neutralisation, Frequency Multipliers, Temperature controlled master oscillators, Balanced Modulator, Peedex lines, matching, Reflection and heating due to mismatch. Discriminators-Pester ceely discriminator, phase and Frequency modulation.

(e) **Rectifiers.**

Various types. Peak inverse voltages. Voltage ratio voltage multipliers. Vibrators. Voltage regulation by vein tube. Half and full wave. Bridge circuits. Ripple factor. Filter, Phase sensitive rectification. Voltage stabilizers, Sof diode and thyatrons-characteristics. Cold tubes. Photo electric cells and tubes.

(f) **Amplifiers.**

Classification, A.F. amplification. equivalent circuit. R.C coupled amplifier. Gainadn frequency response, frequency response on Bias methods. Transformer coupling. D.C. amplifiers. Power amplifiers. Distortion and harmonies. Push pull amplifiers. Advantages, feed back amplifiers. Types of feed back. Effect amplifiers. Types of feed back. Effect on gain distortion phase, frequency response and internal impedance. Gain and tone controls. Cathode invertors. Operational amplifiers, Long-tained pair. Magnetic amplifiers. RF amplifiers. Tuned loads and types of RF coupling and their frequency response. Band pass amplifiers. Miller effect. Neutralisation A.G.C. I.F. amplifiers, VHF and UHF amplifiers coupling systems. Transit time. Logarithmic amplifier. Pulse Techniques. Pulse amplifiers, cathode followers, clamping and

limiting circuits, valve differentiations, blocking oscillator, ringing circuits. Introduction of A Display Principle of A display, paraphase amplifiers

(e) **Oscillators**

Conditions of starting and maintenance of oscillations. Bias and H.T. supplies for an oscillator. Block squigglings. Coupling to load. Frequency stability. Effects of variation of load, voltage and coupling on frequency phase and amplitude. Hartley, Colpitts inverted types tuned anode, tuned grid, electron coupled electron and Fraunhofer oscillators. Amplitude control, wave shape, B.F.O. R.C. oscillator. Parasitic oscillations and its elimination. UHF oscillators. Valves used. Special features of circuits and components. Frequency drift. Master oscillator buffer stage A.F.C piezo electric effect. Crystal oscillators. Mountings. Frequency standard. Frequency multipliers. Partial crystal control.

(f) **Modulation**

(i) ***Amplitude modulation.*** Principles. Different methods of amplitude modulation. Depth of modulation. Side bands. Power content. Anode grid suppressor and screen modulation. Metallic modulators carrier suppression. Balanced modulators.

(ii) ***Frequency and phase modulation.*** Side bands, frequency spectrum choice of frequency. Advantages and disadvantages, Cross modulation, Wide and narrow band F.M. Reactance modulator. Detection. Limitations, Phase conscious circuits. Discrimination.

(g) **Demodulation.**

Diode detectors. Filtering and blocking of unwanted components. Special methods of handling strong and weak signals. Crystal and metallic detectors.

(h) **AM and FM transmitters and receivers.**

Super heterodyne receivers. Double superheterodyne receivers. Sensitivity. Selectivity fidelity, stability and noise of receivers, choice of I.F., for H.F., VHF and UHF receivers. Alignment of receivers. SSB Transmitters and receivers. Jamming and anti jamming devices.

(j) **Current and voltage distribution**

Radiation impedance. Dipole field strength. Polar diagram. Radiated energy and radiation resistance effective height. Electrical length. Serial losses. Input resistance and reactance tuning—aerial feed system. Wide band aerials. Long wire aerials. V aerials. Phonic aerials. Receiving aerials and principles of common aerial working.

(k) **Propagation**

Reflection, Sky wave, skip distance. Propagation characteristics. Square Wave Generators. Multivibrators, Cathode coupled flip flop.

(l) **Noise**

Classification and measurement. Oscilloscopes. Use of double beam oscilloscopes

(m) **Direction finding**

Errors in D.F. at MF, HF and VHF.

(n) **Calibration of D.F. Sets.**

(p) ***Aerials.*** Elements of aerial system. Resonant and non-resonant aerials. Common aerial working. Conical scanning, beam switching.

(q) ***Cathode Ray tubes.*** Electrostatic and Electro magnetic CRT. Electron gun. Focusing. Electromagnetic and Electrostatic deflection. Simple time bases. Double beam tubes. Power supplies. Penta house waveform.

(r) ***Displays—various types.*** PPI Brightening. Fixed scanning coils, sector selection, explanation and tracing of a typical display circuit. Automatic centring. Projection of own movement. Time Bases for Displays. CR time bases, Miller Time Base. Raster Scan, LCD, Plasma Display etc.,

(s) **W/T Sets and Test equipment. Receiver outfits. Pre-refit trials, repairs, overhaul stage inspection, quality control, final inspection, subassembly and major unit testing as per specifications, of following equipment. Also setting to work after installation on board ship.**

(t) **Search Receivers QR/QS. Receivers. DF Outfits. Eecca Navigation sets. Battery outfits. Test equipment. Cathode ray oscilloscopes and wave monitors. Signal generators .Test Oscillators. Pulse generators.**

(u) ***Impedance Bridges.*** Test set receiver and hot set performance. Calibrator range indicators. S.W.R. Indicators high resistance meters. Variable attenuators. Test set insulation . Electronic Multimeter and voltmeter . Test set electronic valve and test set transistors. Frequency counters and wave meters and transistorised types Freq Meters. Test Set telegraph and test set telegraph distortion. Meter noise level. Magslip alignment test set. Voltage measuring unit. Watt Meter description. Decibel Meters and test set Radio. Strobo flash. Pen Recorders and pen recorder amplifiers. Magslip filter detectors.

(v) ***Radar Sets.*** Pre-refit trials, repairs overhaul, stage inspection, quality control, final inspection, subassembly and major unit testing as per specifications of following equipment. Also setting to work after installation on board ship. Post refit and harbour acceptance trials.

- (w) **IFF Sets.** Navigation sets. Warning Sets. Carrier Control approach. Gunnery Radar sets. Teacher Outfits. Display outfits.
 - (x) Theory of L/P Sets, M.F, H.F, VHF. Alignment of L.F sets. Nav aids
 - (y) Tracing and alignment of receivers and UHF sets. Critically maintaining dimensions of components and leads at VHF and UHF. Use of proper tracking tools. Capacitance effect of using non-standard tools, Importance of using screened leads. Proper earthing.
 - (z) **Test Equipment.** Principle of working and use of following test equipment. Valve voltmeter, Electrostatic Voltmeter. Universal AVO meter. Multimeter. Avometers. Wave meters. FM deviation Test set. Test set Radio Oscilloscope. Signal Generators. Test set oscillator and distortion meter. Wee Meggers. Q Meter. Impedance Bridge. SWR indicators. Frequency response Test set. Portable performance Test set. Noise level Meters. Absorption Wattmeter. Decibel Meters.
- (aa) **Drawing and Specifications.**
- = Should be able to draw and understand circuits used in Radar and Transmitters
 - = Should be able to draw simple sketches to explain constructional details of equipment
 - = Specification. Should be able to draw and understand and explain technical details from BRs, Handbooks, specifications, E lists Instruction pamphlets in English and refer to R and B lists (Installation specifications).

Part B**(c) SYLLABUS FOR TRADE TESTING EXAMINATION OF FIRE CONTROL
COMPUTER****1. Servo Elements.**

- (a) Magslip transmitter
- (b) Coincidence transmitter
- (c) Resolver
- (d) Sine cosine rotary transformer
- (e) Selsyns, synchros
- (f) Various types of error measuring devices
- (g) Split filed motors
- (h) Techogenerators

2. Date Transmission. Indication magslip systems**3. Servo Systems.**

- (a) Two element, three element chain
- (b) A/C servo chain and D/C servo chain
- (c) Servo amplifiers
- (d) Amply dynes and metadynes

4. Stabilisers

- (a) Basic functions o a typical Weapon stabilizer
- (b) Basic concept of a free gyroscope
- (c) Precession

5. Hydraulics

- (a) Hydraulic hygiene
- (b) Fitters
- (c) Pumps
- (d) Hydraulic motors
- (e) Non-return valve, stop valve, throttle valve
- (f) Dither control
- (g) Graphical symbols
- (h) Hydraulic fluids
- (j) Various types of seals
- (k) Hydraulic regulators, cylinders
- (l) Flow control methods
- (m) Gauges

6. Test Equipment

- (a) Pen recorders and amplifier
- (b) Dummy directors

7. **Drawings and Specifications.** Ability to read specifications, circuit diagrams, Technical descriptions, pertaining to weapon systems.

8. Practical Experience

- (a) Stripping, overhauling and assembling hydraulic units
- (b) Use of dynamometers
- (c) Use of dummy directors, pen records and amplifiers
- (d) Maintenance of hydraulic hygiene
- (e) Ability to repair and overhaul electromechanical units like plotting labels, GDO rights, wind speed units
- (f) Ability to assist in the STW of gun mountings and fire control system.

9. **Definition of Fire Control Terms.** Range, elevation, training, relative bearing, Compass bearing, inclination, speed, range rate, angular rates, future position, range correction, deflection, own speed, drift, spotting, convergence, tilt, clip, displacement, line of sight, angle of sight, vertical and lateral sight planes, plane of presentation, angle of presentation, ballistic coefficient, ballistic height correction, sight elevation, tangent elevation vertical convergence, dead time, time of flight, future position.

10. **Servo Theory.** Stability of servo, feedback, accuracy of servo, static accuracy, dynamic log, gain control, velocity, feedback, acceleration feedback divided reset, sector value, coarse/fine chain, AC/DC servo, phase advance, pre-retardation, transient velocity feedback, error rate damping, negative velocity feedback effect of backlash and saturation, frequency and transient response of servo

1. Hydraulics

- (a) **Pumps & Accessories.** Displacement, types of pumps, gear pump, vane pump, piston pump, pump rating, accumulators.
- (b) **Hydraulic Fluids.** Fluid properties, fire retardant fluids prevention of leakages, seals.
- (c) **Reservoirs.**
 - (i) Function of reservoir, reservoir
 - (ii) Components, reservoir sizing

- (d) **Contamination Control.** Measuring amount and size of contaminants source of contamination, technique of minimizing contamination during assembly and servicing
 - (e) **Hydraulic Actuators.** Cylinders, motors, regulators
 - (f) **Directional Valves.** Check valves, 2 way, 3 way, 4 way valves, direct acting valves, two stages valves, deceleration valves, rotary valves.
 - (g) **Servo Valves.** Mechanical valves, electro hydraulic servo valves, servo valve performance.
12. **Stabilisation.** Necessity for stabilization, vertical, azimuth and line of sight stabilization, vertical and lateral procession gears, slewing rate measurement, rotation about line of sight.
13. **Basic Weapon Systems.**
- (a) Functional block diagram of a weapon system, Functions of a director, computer and radar of a weapon system.
 - (b) Concept of tracking of a target, co-ordinate system used in weapon system, system accuracy.
1. **STW/Testing and Tuning.**
- (a) Requirement of pre-refit trials
 - (b) Stages in the repair of systems during refit
 - (c) Spares requirement planning
 - (d) STW procedure and pre-requisites
- HATs/SATs procedures

Part B

(d) **SYLLABUS FOR TRADE TESTING EXAMINATION OF SONAR(CONTROLS)**

1. **Basic Concepts.** Propagation of sound in sea. Layers of the Deep Sea and shallow water Profile. The sea bottom, mixed layer sound channel. Deep sea sound channel, Sound Ray Plotter (SRP), Echo Sounder, Snell's Law, velocity intensity, variation of velocity with frequency. Temperature and salinity, Reflection & Scattering. Units of measurements, decibels. Active and Passive Sonar Equation, Source Level, Self Noise Level. Receiving Directivity Index, Detection Threshold, Transmission Loss, Reverberation Level. Ambient Noise level, Target Strength. Target Source Level. Spreading and absorbing and types of noises.
2. **Transducers.** Magnetostrictive, Piezo-Electric / Ceramic - Principle, Advantages / Disadvantages and Materials used. Method of Testing and Measuring Performances. Insulation and Methods of improving Insulation. Prevention Measures against fall of Insulation. Admittance loop Test Equipment Required. Resonance Test, Repairs-Procedures followed, Coupling Coefficient. Difference between elements, staves and transducers. Domes/Hull outfits.
3. **Basics of Sonar Equipment** Beam Pattern, Digital beam forming, FFT,DFT, Beam Width, Shading and Super Directivity, Array Gain, Relation between Source Level and Radiated Acoustic Power Limitation on Sonar Power. Applications-Active & Passive Sonars. Mine Sweeping, Depth Sounding, Mine hunting, Torpedo Homing. Fish Finding. Under Water Telephones with block concepts. variable Depth Sonars. Use of General/Specialised Test. Equipment, Own Ship's course and speed, Own Doppler and Ship's Doppler and correction. Roll and pitch stabilization, principles of sonar SRP.
4. **Sonar Systems.** Basic Block Diagrams, Modes of operation. Operating frequencies, important features and procedures for undertaking major routines, repairs and testing-Tuning of Sonars 184 SS, Diodon, APSOH/HUMVAD, Towed Array Sonar, CSU, CSU 90-14, DUUX, MG 69, MG 79, MGK335, MGK 345, MGK 400, SVR, XBTs, Cavitation Measuring Units. GI 732, MG 16, MG 15, MG 26, GI738, TOTED. SLUTT, Keltron E/s, DESO 10/20/25 and all other Echo Sounders, Emergency Sonar MGS-30.
5. **Log Basics.** Types of Logs, Basic principle of operation determination of speed and distance. Function of RDU and RTUs. Types of Sensors.

6. **Log Systems.** Basic block diagram, important features, major maintenance routines, use of special test equipment and test jigs of MGL 25, MGL 50, Sagem Log, Keltron Log, Log IEL, EM Logs, Log LR-2, Log LGP, LHMPIND. AGI and other Logs.

Part B**(e) SYLLABUS FOR TRADE TESTING EXAMINATION OF INSTRUMENTS****For Foreman & Assistant Foreman(Instruments)**1. *Basic Electronics:*

(a) Semiconductors, diode, transistors, I.C's, amplifiers, Oscillators, Power electronics, Operational amplifiers, analog/digital converters, ramp type digital voltmeters.

(b) Rectifiers. Half wave and full wave, Bridge circuits, Ripple factor, filters, stabilization of H.T. supplies.

(c) Amplifiers. L.F., A.F. Amplifiers, Bias methods, R.C. coupling, Gain and bandwidth. Transformer coupling, push pull amplifiers. Waveform distortion. Negative feedback, long tailed pair.

(d) Resonance and coupled circuits.

2. *Electrical Measuring and Measuring Instruments:*

(a) Measurement of Inductance and capacity. A.C. bridge methods, sources of error supplied for bridge networks.

(b) Measurement of Resistance. Voltage drop method, Potentiometer method. Kelvin double bridge method, wheat-stone bridge method. Sensitivity and accuracy of different methods. Principle of galvanometer.

(c) High voltage measurement. High voltage transformers and voltage regulation. Sphere gap. Potential dividers. Electrostatic voltmeters.

(d) Measurement of Temperature. Electrical resistance pyrometers. Resistance variation with temperature. Indicators and recorders. Thermoelectric pyrometers, thermoelectric E.M.F. amplifiers and control panels associated with pyrometers. Compensating leads, Platinum Rhodium or Platinum iridium thermocouples.

(e) Measuring Instruments. Classification. Absolute and secondary instruments. Indicating instruments. Control, balancing and damping, constructional details.

(f) Ammeters and Voltmeters. Classification of instruments. Errors in ammeters and voltmeters. Moving iron instruments. Theory of attraction and repulsion types. Errors in M.I. Instruments. Moving coil instruments. Permanent magnet types. Extension of range of moving coil instruments. Hot wire instruments. Electrostatic instruments. Compensation for frequency and temperature, shunts. Voltmeter multipliers. Instrument transformers and precautions while using XW meters, frequency meters. Phase or power factor meters. Synchrosopes. Tong testers.

(g) Principle and operation of various types of mechanical and electrical transducers, non contact type speed measurement, basics of digital data acquisition systems and its elements like transducer, signal conditioner, signal converters, A/D converters, displays etc

(h) Level indicating/measurement systems, Impressed current cathodic protection system

(j) *Mechanical Instruments:*

(i) Thermo-electric e.m.f, pyrometers, amplifiers, and control panel associated with pyrometers, compensating leads, Platinum Rhodium or platinum iridium thermo couples.

(ii) Principle of working and constructional details of R.P.M. indicators, tachometers, revolution counters, theory of wheat stone bridge, direction and revolution indicators, rudder indicators, pitch indicators, steering order transmitters, Variation of resistance with change in strength of chemical solution. Salinity indicators and recorders.

(iii) Principle of working and constructional details of clock work mechanism, submerged and time delay mechanisms, relays, speed and distance transmitters, receivers, indicators and recorders. Wind speed and direction indicators. Pitometer and Chernikeef logs.

(iv) Principle of working and constructional details of time recorder time clocks, watches etc.

(k) *Optical Instruments:*

(i) *Light Theory.* Reflection of light, laws of reflection, magnification, Laws of Refraction, Critical angle, apparent depth. Refraction of light

through prism refraction through lens, focal power, magnification of a lens, focal length, refraction index. Dispersion of light, Line of sight, effect of movement of telescope effect of power on deviation of rays, adjustment of line of sight, line of sight of binoculars.

(ii) *Centering of lenses.* The axis of lens. Decentred lenses, Notation of lenses. The Dioptre, Method of adjusting line of sight of a telescopic – the collimeter. Focussing a collimeter. Test for Spherical observation elements of sighting telescope. Adjustment of line of sight, centric rings, Adjustment of line of sight 4 screw method. Accuracy required in sighting instruments. Adjustment of diopter scale. Adjustment of binoculars for interocular distance. Image creation. Prism system.

(iii) *Specification of Tests for Instrument.* Accuracy of diopters scales. Lining up test-cylindrical sighting telescope. Accuracy of focusing of graticouled instruments. Parallelism of binocular barrels. Verticality of images of binoculars. Intercular scales of binoculars. Lining up of graticuled binoculars (base mounted). Mechanical test – shock test. Air and water tightness test.

(iv) Optical constants. Measurement of field of view. Measurement of graticule markings. Measurement of prism deflection.

(v) Optical Performance. Definition, colour curvature, astigmatism. Eye freedom.

(vi) Telescopic and Binoculars Test Bench. General construction telescope unit. Adjustable table. Brackets for binoculars and telescopes. Collimeter unit.

(vii) Maintenance and Adjustment of Bench. Stripping – General, stripping and Rhomboid prism. Removing the object glasses. Removing eyepiece lenses. Removing graticulers. General cleaning and lubrications. Reassembly and realignment. Realignment of telescope and collimeter. Alignment of adjustment table.

(viii) Component parts of Optical equipment. Object glass, field lens, erector lens, cross wires, eyepiece assembly eye lens, sliding tube. Body tube, diopter ring and scale variable power scale definition of line of sight, prism box, focusing eccentric mount and ring filters, graticules, spray shields.

- (ix) Greases. Use of belomoline. A or belomoline H.P. greases.
- (x) Drying out. Use of vacuum desiccating pump ARL desiccating attachment drying with the help of radiator or source of heat. Effect of humidity in official instrument. Hair hygrometer and pressure desicator.
- (xi) Care of lenses and optical glasses. Avoiding rubbing with fingers or piece of rag.

4. *Instruments*. Pre-refit trials, repairs, overhaul, stage inspection, quality control, final inspection and calibration of following instruments:

Tachometers (Electrical and Mechanical), revolution counters, R.P.M Indicators, Engine Direction and revolution indicators, steering order transmitters, speed and distance indicators, recorders, transmitters, receivers. Wind speed and direction indicators. Barometers. Cadburn indicators. Chernikeef log and pitometer log. Pyrometers, thermocouples, temperature gauges, capacity gauges. Salinometers and recorder clocks. Time clocks. Clock and clockwise mechanism/Delay mechanism, submerged mechanism. Ammeters including long tester and thermo couple types. Voltmeters including electrostatic voltmeters. Frequency meters (Electrical) Kilowatt meters and energy meters. Power factor meters, synchrosopes.

Avometers and multimeters, galvanometers (Ballastic, 'D' Arsonval and Vibration types). *Flux meters. Vee and bridge meggers, and ohm meters. P.H. motors, telephone tele printer and typex machines, cinema projectors, Binoculars, variable power gun sighting telescope. Variable power high angle gun sighting telescope. Variable power high angle gun sighting telescope, prismatic gun-sighting telescope, control officers forward area sight, gun sighting binoculars. Captain's sight binoculars, control officers binoculars, theodolities, periscopes. Clinometers, sextants, mirror sextants, range finders. Bonotype dividers, boat compass, magnetic compass, dial cameras, star globe, desicators, microscopes, D.A.B. sight reflector sight, reflector sight M.C.O. sight IBM collimeters, gyro sights.

For Chargeman I & II (Instruments)

1. Basic Electrical Engineering. Units and dimensions, factors determining resistance of a conductor, dependence on temperature, colour code.

(a) Electromagnetism. Magnetic fields due to current carrying conductors solenoids etc. magnetizing force, flux, density, permeability. B/H curves. The magnetic circuit, M.M.F. and reluctance. Effect of the air gap Induced EMF Faraday's and Lenz's laws. Self induction mutual induction. Hysteresis and eddy current losses.

(b) Electro-station. Electric field between parallel plates. Electric force capacitance.

(c) Circuit Theory. Three circuit elements (resistance, inductance and capacitance) Ohm's law and Kirchoff's laws. Solution of series and parallel networks. Power in circuits. Power factor. Two and three phase supplies. Star and delta connections. Relation between line and phase values.

(d) Waveforms and harmonics.

(e) Measuring instruments. Basic principle of Moving Coil, moving iron, electrostatic meters, ammeters, voltmeters, ohmmeters, meggers, multimeters, valve voltmeter, valve tester, signal generators.

(f) Generators, alternators, motors and transformers. Basic principle of working of D.C. and A.C. Generators and motors and transformers.

2. Any one of the following subjects depending on the background and practical experience gained as Instrument Mechanic:

(a) Electrical Instruments.

(b) Mechanical Instruments.

(c) Optical Instruments.

(a) *Electrical Instruments.*

(i) Basic Electronics, amplifiers, rectifiers.

(ii) Thorough knowledge of mag slip and servo elements as detailed in syllabus for Control Fitter (Instruments)

(iii) Thorough knowledge of principle of working of electrical measurements

and constructional details; Ammeters, voltmeters, wattmeters, KW meters.

Frequency meters, Phase sequence indicators, power factor meters, synchrosopes, valve voltmeter, meggers, etc.

(iv) Thorough knowledge of typex machines.

(v) Thorough knowledge of test rigs and calibration equipment for instrument detailed in (iii) above.

(b) Mechanical Instruments:

(i) Thermo-electric e.m.f pyrometers, amplifiers and Control panel associated with pyrometers, compensation leads platinum, Rhodium iridium thermocouples.

(ii) Principle of working and constructional details of R.PM.Indicators, tachometers, revolution counters, theory of wheatstone bridge, Direction

and revolution indicators, Rudder indicators, pitch indicators, steering order transmitters, variation of resistance with change in strength of chemical solution. Salinity indicators and recorders.

(iii) Principle of working and constructional details of clock work mechanisms, submerged and time delay mechanisms, relays, speed and distance transmitters, receivers, indicators and recorders Wind speed and direction indicators, Pitometer and Kerri chef logs.

(iv) Principle of working and constructional details of time recorder time
clocks, watches etc

(c) Optical Instruments:

(i) Light Theory: Reflection of light, laws of reflection, Magnification, Laws of Refraction, Critical angle, apparent depth, refraction of light through prism, refraction through lens, focal power, Magnification of a lens, focal length, Refraction index, dispersion of light. Line of sight, effect of movement of telescopic effect of power on deviation rays, adjustment of
line of sight, line of sight of binoculars.

(ii) Centering of lenses. The axis of lens. Decentred lenses. Notation of lenses. The diopter. Method of adjusting line of sight of a telescope – The collimeter. Focussing a collimeter. Test for spherical observation. Elements of sighting telescope. Adjustment of line of sight, eccentric rings, Adjustment of line of sight 4 screw method. Accuracy required

in

sighting instruments. Adjustment of diopter scale. Adjustment of binoculars for parallelism. Adjustment of binoculars for intraocular distance. Image erection lens system. Image erection. Prism system. Verticality of image.

(iii) Specification of Test for Instrument. Accuracy of diopter scales. Lining up test-cylindrical sighting telescopes. Accuracy of focusing of graticulated instruments. Parallelism of binoculars barrels. Verticality of images in binoculars, Intraocular scales of binoculars. Lining up of graticuled binoculars(base method). Mechanical Tests – Shock test, air and Water tightness test.

(iv) Telescope and Binocular Test Bench. General construction telescope unit. Adjustable table. Brackets for binoculars and telescopes. Collimeter unit.

(v) Maintenance & Adjustment of Bench. Stripping – General, Striping the

Rhomboid prisms, Removing the object glasses, removing eyepiece lenses. Removing graticules. General cleanliness and lubrication.

Reassembly and realignment – Realignment of telescope and collimeter.

Alignment of adjustment table.

(vi) Component Parts of Optical Equipment. Object glass, field lens, erector lens, cross wire, eyepiece assembly, eye lens, sliding tube, body tube, diopter ring and scale variable power scale definition of line of sight, prism box, focusing eccentric mount and ring, filters, graticule, spray shields.

(vii) Greases. Use of belomoline A or belomoline H.P. Greases, Drying out care of lenses and optical classes.

(viii) Drying out. Use of vacuum desiccating pump. ARL desiccating attachment drying with the help of radiator of source of heat. Effect

of

humidity in official instruments. Hair hygrometer and pressure desiccator.

(ix) Taking down instruments. Marking position and number of grub screws with age. Making a joining air and moisture tight.

(x) Care of Lenses and Optical Glasses. Avoiding rubbing with fingers or piece of rag.

(xi) Cleaning. Use of soft camel hair brush in preference to linen or cambric pair, fur, alcohol, optical tissue paper. Avoiding use of chamois leather and selvyts. Procedure for cleaning, Blooming, cementing, sealing, reassembling. Use of beeswax. Maintenance of solutions. Paints,

Internal

optical black paints. Maintenance of linen square and brush.

(xii) Use of special tools. Use of dolly for lens cleaning, pin spanner for large

ring nut; keys for retaining ring, field lens and night illumination lens.

(xiii) Practical experience. Stripping, cleaning, drying and reassembling of

binoculars, variable power gun sighting telescope, prismatic gun sighting

telescope, control officer's forward area sight, gun sighting binocular, P.S.D. Gun sighting binoculars, Captain's sight binoculars. HACS, binoculars, General purpose binoculars, stereos spotting binoculars, Control Officer's binoculars.

(xiv) Optical Constants. Measurement of field of view, measurement of graticule markings. Measurement of prism deflection.

(xv) Optical Performance. Definition, colour, curvature, Astigmatism, Eye

freedom.

(xvi) Outdoor Apparatus and Test Gear. Outdoor test boards in field and gear

in room connected with these test. Using test object in field.

(xvii) Test Equipment. Use of following test equipment D.A.B.S Collimeter

Bench:

Collimation bench for Binocular Gun sights.

Parallelism Test Bench.

T.I.U. Projector's Test Bench.

Air tightness Testing Equipment.

Bench for collimation of Radar alignment.

using
parallax

Testing of D.A.B.S Mk.1 Setting of collimeters for infinity focus
focusing telescope with dial attachment, using collimation and
method, using a theodolite and a pentagonal prism.

Use of theololite, Angle Dekker, 18" Ante collimeter, Instrument

testing scale and accessories, optical meter, field angle
measuring instrument, meter.

(xviii) Dark room apparatus. Use of light transmission apparatus test
bench for slope or erection of image. Despite scale test bench.

Part B**(f) SYLLABUS FOR TRADE TESTING EXAMINATION OF GYRO****For Foreman & Assistant Foreman (Gyro)**1. *Basic Electronics:*

- (a). Semiconductors, diode, transistors, I.C's, amplifiers, Oscillators, Power electronics, Operational amplifiers, analog/digital converters, ramp type digital voltmeters
- (b) Rectifiers: Half wave and full wave. Bridge circuits. Ripple factor. Stabilization of H.T supplies; Phase sensitive rectification, electronic voltage stabilizers, Carbon pile regulators.
- (c) Amplifier: I.A.A.F. and D.C amplifiers, Bias method, R.C coupling. Gain and bandwidth, Transformer coupling. Push pull amplifiers. Waveform distortion. Negative feedback, Long tailed pair.
- (d) Resonance and coupled circuits.

2. *Data Transmission and Basic Servo Theory:*

- (a) Data Transmission and Magslips. M type indicator and power magslip principles. F.T.G. C.O.T; X Co, T, power magslips. Synchronos, Resolver, Moving coil hunters, H.F. Magslips, E type pickups, coarse and fine magslip chains. Effects of change in connections.
- (b) Servo Systems. Servo elements, split field motor servo, A.G.Servos, associated pick up arrangements, gyro amplifiers stability, accuracy and response of a servo.

3. Servo Performance Test Equipment. Dummy director, pen recorder, recorder amplifier, sweep frequency generator, misalignment meter.

4. *Gyro Theory:*

- (a) Gyroscope, free gyroscopic inertia, precession, effects of earth's rotation on the axis of the 'Free Eye', sensitive element.
- (b) Latitude rider, mercury control, theory of un damped gravity controlled gyro, mercury boxes.

(c) Dumping, motion of a gravity controlled damped compass, damping factor and percentage damping, damping error.

(d) Effects of certain incorrect Adjustment of the common. Effect of an extraneous torque about the vertical, misalignment of the phantom with respect to the sensitive element. Casing North or South heavy, a change in the speed of the rotor, Mercury boxes, North or South Heavy.

(e) Gyro Compass in a ship. Effect of ship speed, speed corrector, ballistic deflection, ballistic tilt and acceleration errors. Rolling errors. Geometric errors (Suspension not vertical, gimbaling error).

5. Master Compass Basic Components. Constructional details and working of:-

(a) Sensitive elements, mercury boxes, phantom, spider, binnacle ring, Anti shock.

(b) Electric supplies.

(c) Various follow up system: follow up transformer, amplifier, azimuth motor relay.

(d) Transmission system: Sperry type transmission, compass transmitters, relay transmitters, multiple transmitters, bottle transmitters, spark suppression. Tape type, pressure tight, azimuth or steering repeaters.

(e) Alarm system and control panels.

6. Equipment, Test, Trials, Inspection and Quality Control. Pre-refit trials, repairs, overhaul, stage inspection, quality control, final inspection, sub-assembly and major unit testing as per specifications of following equipment:-

Gyro Compass.

AGMC LTMC.

Compass retransmission units.

Sperry type Gyros.

Compass control panels and alarm systems.

Gyro repeaters, Telephones.

For Chargeman I & II (Gyro)

1. Basic Electrical Engineering. Unit and dimensions, factors determining resistance of a conductor, dependence on temperature, colour code.
 - (a) Electromagnetism; Magnetic fields due to current carrying conductors, solenoids etc. Magnetizing force, flux density permeability. B/H curve. The magnetic circuit, M.M.F, and reluctance. Effect of air gap. Induced E.M.F Faraday's and Lenz's laws. Self induction mutual induction. Hysteresis and eddy current losses.
 - (b) Electrostatics: Electric field between parallel plates electric force, capacitances.
 - (c) Circuit Theory: Three circuit elements (resistance, inductance and capacitance). Ohm's law and Kirchoff's laws. Solution of series and parallel networks. Power factor. Two and three phase supplies. Star and Delta connections. Relation between line and phase values.
 - (d) Waveforms and harmonics.
 - (e) Measuring Instruments – Basic principle of moving coil, moving iron, electrostatic meters, ammeters, voltmeters, Ohmmeters, meggers, multimeters, valve voltmeters, valve tester, signal generators.
 - (f) Generators, Alternators, motors and transformers. Basic principle of working of D.C and A.C generators and transformers.
 - (g) Semiconductors, diode, transistors, I.C's, amplifiers, Oscillators, Power electronics, Operational amplifiers, analog/digital converters, ramp type digital voltmeters
2. Need for stabilized power supplied and effect of variations in main supply voltage on speed, frequency.
3. Static and dynamic balancing of gyro rotors. Balancing of case with rotor and vertical ring.

4. Complete renewal, overhaul, onboard testing of navigational gyros, magnetic compasses and repeaters, sea trials.

5. For promotion Gyro Mechanic Control Fitter (Instruments) will be examined in accordance with the following syllabus in addition to that specified for control Fitter (Instruments).

(a) Should be able to draw and understand simple electrical circuits and produce simple mechanical sketches of parts to express.

(b) Should be able to read and understand B.Rs; handbooks specifications, Instructional pamphlets in English.

(c) Kirchoff's law and solution of simple circuit diagrams with resistive components.

(d) Knowledge of small D.C and A.C machines conditions for spark commutation. Coaling and ventilation arrangements.

(e) Basic Electronics, Rectifiers and amplifiers.

(f) Knowledge of split field motor servo system with associated pick up arrangements amplifiers and servo elements. Stability of servo.

(g) Properties of a free gyro; rigidity in space and precession.

(h) Apparent behaviors of a free gyro at equator, pole and at intermediate latitude.

(j) Conversion of a free gyroscope to a gyro compass: Function of latitude rider, function of ball weights, mercury boxes, damping setting time.

(k) Errors due to twist, imbalance, incorrect rotor speed, speed of ships, ballistic deflection, acceleration error, roll of ship.

(l) Complete working of 1005, 2005 and 2005 and 5005 gyro compasses.

- (m) Master compass follow up and transmission systems. M.T.U. Gyro amplifier Patt. 8165, C.R.U; Compass control panel and alarm system, electrical supplies of gyro.
- (n) Gyro Repeaters.
- (o) Magnetic Compass. A.T.M.C.
- (p) Principle of operation of A.T.M.C Km 5 & 6.
- (q) Should be capable of carrying out annual routine on gyro.
- (r) Principle of working of S.P. and other telephones, auto exchange.
- (s) Should be capable of using test rigs for ship tests.
- (t) Testing of backlash in M.T.U. and C.R.U.

CONSTRUCTION

Part – A – Common Syllabus for Construction Trade

Note :- A meaning of the symbols used in syllabus for the knowledge expected from the various categories is as follows: -

- A - Complete understanding of the subject
 B - Good knowledge of the subject
 C - Working knowledge of the subject

Standard of knowledge
required for promotion to

<u>SNo</u>	<u>Subject</u>	<u>F/M</u>	<u>Asst F/M</u>	<u>C/M-I</u>	<u>C/M-II</u>
01.	Safety and use of equipment				
	a) Cleanliness of working area	A	A	A	A
	b) Fire and safety precautions	A	A	A	A
	c) Hand fire fighting Appliances	A	A	A	A
	d) First aid	A	A	A	A
02.	Administration				
	a) P forms, K forms accident report forms	A	A	A	B
	b) Action in case of an accident	A	A	A	A
	c) Procedures for demanding spares materials	A	A	A	B
	d) Procedure for requisitioning cranes, Lister, Lighting connections	A	A	A	A
	e) Procedure for requisitioning ATM(M) departments assistance in shop maintenance	A	A	A	B
03.	Man Management	A	A	A	B
04.	Work planning	A	A	A	B
05.	Establishment organization	A	A	A	A
06.	Availability of skilled manpower	A	A	A	B
07.	Preventive measures and importance of personnel and public hygiene	B	B	B	C
08.	Workers education	A	A	A	B

09.	Discipline, entertrainer in higher production and greater efficiency. Code of discipline and code of conduct.	A	A	A	B
10.	Productivity – Its meaning and importance	B	B	B	C

Part B

(a) SYLLABUS FOR TRADE TESTING EXAMINATION OF *PLATER*

For Foreman & Asst. Foreman – Plater

1. Engineering Drawing. Knowledge of geometrical and Engineering drawing. First and Third angle projection, various types of scale used. Detailed Knowledge of Engineering drawing and its conventions as per I.S.S. 696/1960. Isometric views and drawing of simple sketches. Through knowledge of British and Metric system of measurements and conversion from one system to another. Knowledge of ship building drawing, lines plan/sheer draught.

2. Materials used in Ship Building.

- (a) Various parts of a ship
- (b) Chemical composition and metallurgical aspects
- (c) Physical and Mechanical properties.
- (d) Uses.

3. Ship Building Terminology.

- (a) Geometry of ship
- (b) Various parts of ship
- (c) Nomenclature of various Compartments.
- (d) Layout of a ship.
- (e) Modern Techniques of ship building.

4. Steel Plates and Sections. Classification of quality of steel plates and sections as per DG Ships specification as well as rules of Lloyd's Register of Shipping and Indian Navy Identification markings and composition of various type of ship building steel. Knowledge of I.S.S. 808/1964 and I.S.S. 1252/1960 and equivalent B.S.S. regarding the availability of various steel sections and their properties.

5. Corrosion. Adequate knowledge of process of corrosion as it occurs on ships, corrosion allowance in ship structure.

Means of Preventing Corrosion:-

- (a) Sacrificial anodes method
- (b) Impressed Current method
- (c) Anticorrosive paints.

6. Welding. Fundamental knowledge of various type of Welding process and the application sequence of welding to cause minimum distortion and residual stress. Types of electrodes and precautions used for welding of:

- (a) Notch Ductile Steel

- (b) Stainless Steel.
- (c) Austenitic Steel
- (d) Hard Field Steel
- (e) High Tensile Steel
- (f) Cast Steel
- (g) Special Alloy Steels
- (h) Aluminium
- (j) Aluminium Alloys
- (k) Copper

7. Techniques used in Ship Building/Ship Repairs. Knowledge of edge preparation prior to welding knowledge of decision of welded joint.

- (a) Riveting-Knowledge of design of a riveted joint. Types of rivets and their uses, Types of joints, spacing of rivets pitch margin admissible tolerance, selection of size of rivets.
- (b) Riveting of aluminium to steel.
- (c) Water tight/oil tight joint, frame to beam joint, plate joined to a joggled frame. Bulk head to deck joint, stringer angle to deck and Shell.
- (d) Reading and interpretation of templates received from mould loft.
- (e) Cold and hot bending of plates and sections.
- (f) Prefabrication techniques and sequence of fabrication and erection.
- (g) Lifting/handling of a prefabrication panel.

8. Hull Fabrication Shop Machinery:- Types of machinery, functions, uses, limitations, likely defects, maintenance and requirements of spares. Technical evaluation and comparative study of performance from the available technical for selecting a machine. Various types of hand tools and its uses.

9. Hull Survey. Technique of Hull survey, purposes, periodicity, detection of likely defects preparations of survey reports.

10. Testing. Technique of testing of compartments and tanks for water and air tightness, detection of leaks and their rectifications, permissible standard.

11. Structure. Knowledge of stress, strain relationships, yield point factors of safety & simple formulae for bending & deflections of beams

- (a) Knowledge of stress and Strain curve.
- (b) Elementary knowledge of
 - (i) Brittle Fracture.
 - (ii) Work Hardening.
 - (iii) Fatigue.
 - (iv) Age Hardening.

(v) Notch Formation.

1. Sheet Metal
 - (a) Types of material, their uses, composition and properties.
 - (b) Knowledge of nibbling, notching, flanging, shearing, bending, shaping and rolling.
 - (c) Knowledge of brazing, soldering and spot/resistance welding.
 - (d) Riveting of aluminium, copper and brass sheets upto 1/4"
 - (e) Knowledge of ventilation and air-conditioning system of ships.
 - (f) Types of suction used, various components of the system, measurements of air flow Rate.
 - (g) Development of curved surface and material estimates.

2. Testing of Anchor Chain Cables and Associated Gear. Detailed knowledge of:-
 - (a) Test House equipment.
 - (b) Types of premises.
 - (c) Maintenance of equipments.
 - (d) Testing load of various items as per Lloyds Register of shipping and Indian Navy.
 - (e) Physical and mechanical properties of materials of items under test.
 - (f) Heat treatments.
 - (g) Preparation of test reports.

3. Forgings :- Detailed knowledge of :
 - (a) Light and heavy forging.
 - (b) Drop and die forging
 - (c) Hydraulic, pneumatic and electric hammers.
 - (d) Hot and Cold forging machines.
 - (e) Non-destructive testing of forges.

15. Galvanising Technique of galvanizing, purpose, uses, types of Galvanising baths, pickling, properties of zinc. Inter action between zinc and bath material. Acceptable standard of galvanising as per I.S.S.

For Chargeman-I – Plater.

1. Engineering Drawing. Knowledge of geometrical and Engineering drawing. First and Third angle projection, various types of scales used. Detailed Knowledge of Engineering drawing and its conventions as per I.S.S. 696/1960. Isometric views and drawing of simple sketches. Through knowledge of British and Metric system of measurements and conversion from one system to another.

2. Materials used in Ship Building.
 - (a) Geometry of a ship
 - (b) Various parts of ship

- (c) Layout of a ship.
 - (d) Modern Techniques of ship building.
3. Terminology. Terms used to describe:
- (a) Geometry of a ship
 - (b) Various parts of ship
 - (c) Layout of a ship.
 - (d) Modern Techniques of ship building.
4. Steel Plates and Sections. Classification of quality of steel plates and sections as per DG Ships specification as well as rules of Lloyd's Register of Shipping and Indian Navy. Identification marking, composition Knowledge of I.S.S. 1252/1960 and equivalent B.S.S. regarding the availability of various steel sections and their properties.
5. Corrosion. Understanding of basic principle of process of corrosion as it occurs on ships, corrosion allowance in ship structure.
Means of Preventing Corrosion:-
- (a) Sacrificial anodes.
 - (b) Impressed Current method
 - (c) Anticorrosive paints.
6. Welding. Fundamental knowledge of types of welding process and their application. Sequence of welding to cause minimum residual stresses. Type of electrodes and precautions used for welding of:
- (a) Notch Ductile Steel
 - (b) High Tensile Steel
 - (c) Cast Steel
 - (d) Aluminum
 - (e) Copper
7. Techniques used in Ship Building/Ship Repairs
- (a) Riveting. Types of rivets and their uses, Types of joints, spacing of rivets pitch margin admissible tolerance, selection of size of rivets.
 - (b) Riveting of aluminium to steel.
 - (c) Water tight/oil tight joints, frame to beam joint, plate joined to a joggled frame, bulk head joined to shell plating and bulk head to deck joint.
 - (d) Reading and interpretation of templates received from mould loft.
 - (e) Technique of "Optical Marking" of plates.
 - (f) Development of shell plates having curvature in one or two direction.
 - (g) Cold and hot bending of plates and sections.
 - (h) Sequence of fabrication and erection.
 - (i) Lifting/handling of a prefabricated panel.

8. Hull Fabrication Shop Machinery:- Types of machinery, functions, uses, limitations, likely defects, maintenance and requirements of spares. Technical evaluation and comparative study of performance from the available technical Data for selecting a machine. Various types of hand tools and its uses.

9. Hull Survey. Technique of Hull survey, purposes, periodicity, detection of likely defects preparations of survey reports.

10. Testing. Technique of testing of compartments and tanks for water and air tightness, detection of leaks and their rectifications, permissible standard.

11. Steel Metals:-

- (a) Types of materials, their uses, composition and properties.
- (b) Knowledge of nibbling, notching, flanging.
- (c) Knowledge of brazing, soldering and spot/resistance welding.
- (d) Riveting of aluminum, copper and brass sheets upto 1/4"
- (e) Knowledge of ventilation and air-conditioning system of ships. Types of suction used, various components of the system, measurements of air flow Rates.
- (f) Development of curved surface and material estimates.

12. Testing of Anchor Chain Cables and Associated Gear. Detailed knowledge of:-

- (a) Test out equipment.
- (b) Types of premises.
- (c) Maintenance of equipments.
- (d) Testing load of various items as per Lloyds Register of shipping and Indian Navy.
- (e) Physical and mechanical properties of materials of items under test.
- (f) Heat treatments.
- (g) Preparation of test reports.

13. Forgings :- Detailed knowledge of :

- (a) Light and heavy forging.
- (b) Drop and die forging
- (c) Hydraulic, pneumatic and electric hammers.
- (d) Hot and Cold forging machines.
- (e) Non-destructive testing of forges.

14. Galvanising. Technique of galvanizing, purpose, uses, types of Galvanising baths, pickling, properties of zinc. Interaction between zinc and bath material. Acceptable standard of galvanising as per I.S.S.

For Chargeman-II – Plater

1. **Engineering Drawing.** Fundamental knowledge of geometrical and mechanical engineering drawing. First and Third angle projection, various types of angles used in engineering drawing. Different conversions used for representation of materials, standard symbols, tolerance, surface finish etc as per I.S.S. 696/1960.

Fundamental knowledge of British and Metric systems of measurements. Conversion from one System to another.

2. **Terminology.** Various terms used to describe the parts of ship and in ship building practice.

3. **Materials.** Various types of materials used in ship building, their properties and uses.

4. **Steel Plates and Sections.** Classification of quality of steel plates and sections as per rule of Lloyd's Register of Shipping and Indian Navy. Identification markings. Knowledge of I.S.S. 808/1964 I.S.S. 1252/1960 and equivalent I.S.S. regarding the availability of various steel sections and their properties.

5. **Corrosion.** Fundamental knowledge of chemistry of rust formation and its prevention by various active and passive means.

6. **Welding.** Fundamental knowledge of welding process, types of electrodes and their uses. Knowledge sequence of welding and its significances. Precautions for preparation prior to welding.

7. **Techniques used in Ship Building/Ship Repairs**

- (a) Riveting. Types of rivets and their uses, Types of joint, spacing of rivets pitch margin admissible tolerance, selection of size of rivets.
- (b) Aluminium to steel riveted joints.
- (c) Water tight joint- longitudinal passing through a bulk head, frame to beam joint, plate joined to a joggled frame, bulk head joined to stringer angle to deck and shell plating and bulk head to deck joint.
- (d) Reading and interpretation of templates received from mould loft.
- (e) Development of shell plates having curvature in one or two direction.
- (f) Cold and hot bending of plates and sections.
- (g) Sequence of fabrication and erection.
- (h) Lifting/handling of a prefabricated panel.

8. **Steel Fabrication Shop Machinery:-** Various types of machinery, functions, uses, limitations, likely defects, maintenance and requirements of spares. Types of hand tools and their uses.

9. **Hull Survey.** Techniques of Hull survey, purposes, periodicity, detection of likely defects preparations of survey reports.

10. **Testing.** Technique of testing of compartments and tanks for water and air tightness. Detection of leaks and their rectifications, acceptable standard.

11. **Steel Metals:-**

- (a) Types of materials and its uses.
- (b) Knowledge of nibbling, notching, flanging, shearing, bending, shaping, and rolling.
- (c) Fundamental knowledge of brazing, soldering and spot or resistance welding.
- (d) Riveting of aluminium, copper and brass sheets upto ¼"
- (e) Knowledge of ventilation and air-conditioning system of ships.
Types of suction used, various components of the system, measurements of air flow rates.
- (f) Developments of curved surfaces and material estimates.

12. Testing of Anchor Chain Cables and Associated Fittings, Fundamental knowledge of:-

- (a) Test House equipment.
- (b) Testing load of various items as per Navy Rules.
- (c) Preparation of test reports.
- (d) Heat treatments.

13. Forging and Galvanising, Fundamental knowledge of :

- (a) Light and heavy forging.
- (b) Drop and die forging
- (c) Galvanising process and equipment required.

Part B

(b) SYLLABUS FOR TRADE TESTING EXAMINATION OF *SHIP FITTER*

For Chargeman-II (Ship Fitter)

1. All types of hand tools and measuring instruments used in working with metals and pipes.
2. Use of various types of drills, Bench and pillar drilling machines, holding devices, vices, vee blocks, Drill sizes, Reaming, various type of reamers, various cutting fluids.
3. Use and principles of milling machines and shaping machines, Milling cutters etc.
4. Use and principles of lathes, lathe tools and tool grinding, angles, drilling reaming, boring, thread cutting on a lathe, various types of threads and their application.
5. Use of workshop machinery e.g. Grinders, power Hacksaw pipe.
6. Ships services/systems e.g. F.W. services, Domestic services, Sanitary services, Pumping flooding and draining arrangements, Air escape arrangements, voice and Message carrier pipes, Magazine flooding and spraying arrangements, Hangar and inflammable stores spraying arrangements, flooding cabinets, Domestic and valve controls.
7. Various types of valves used in systems, and services e.g. Seacock valves, S.D.N.R.V., SDNR Flood valves, DFSV sluice valves, Non return valves, storm valves, Reducing valves, Flushing valves, hot and cold water mixing valves Bid cocks, pitometer valves, ventilation slide valves etc. Charni Keff log valves.
8. Rod gearing used for controls of various valves, Mitro wheels, Gear wheels Ball bearing buckets, Universal joint and Expansion coupling, stuffing boxes, Locking arrangements, strainers mud boxes etc.
9. Principles of working of W.T. Doors, hatches side scuttles, square ports, escape scuttles manholes, skylights and their associated arrangements, ventilation flaps Recirculation flaps etc.
10. Various types of lighting appliances used in ships and craft of Indian Navy e.g. Radial, welding, Gravity, Skid beam type, Torpedo, Mine sweeping devits, Ammunition derricks and cranes.

11. Knowledge of various types of hull outfits fitted in Naval ships.
12. Manually operated pumps and winches.
13. Aircraft lifts, Rocket and Bomb lifts, HF/DF Mast aerials.
14. Miscellaneous fittings, e.g. Telegraphs counters Revolution counters, Rolling shutters, steel and wooden blocks, Accommodation ladder, and boom fittings, fair leads and Tripods, wire reels, Motor boat filling, Blow lamps, lanterns, fire extinguishers, Hydraulic jacks, spray painting Guns.
15. Mechanically operated steering arrangements.
16. Valves, pipes and rod gearings fitted in caissons and dockgates.
17. Various types of fasteners and joining materials applicable to fittings and services enumerated in the preceding paragraphs.
18. Various materials used for the fittings/services described in the preceding paragraphs.

For Chargeman-I (Ship Fitter)

7. All types of hand tools and measuring instruments used in working with metals and pipes.
8. Use of various types of drilling machine holding devices, Reaming, various cutting fluids.
9. Use and principle of lathes, drilling reaming, Boring, thread cutting on a lathe, Various types of threads and their application.
10. Use and principles of milling machines and shaping machines, Milling cutters etc.
11. Use of workshop machinery e.g. Grinders, power hacksaw pipe bending presses/Machines etc.
12. Detailed Knowledge of ships services e.g. F.W. services, Domestic services, Sanitary services, Pumping flooding and draining arrangements, Air escape arrangements, voice and Message carrier pipes, Magazine flooding and spraying arrangements, Hangar and inflammable stores spraying arrangements, flooding cabinets, Air filtration Units, various filters.

13. Rod gearing used for control of various valves, Mitro wheels, Gear wheels, Gear wheels, Ball bearing buckets, universal joint and units couplings locking arrangements etc.
14. Principles and working of various types of valves fitted in services and systems e.g. Seacock SDNR valve, SDNR Flood valves D.F.S.W. sluice valve, non return valve storm valve, Reducing valves, Flushing valve, Hot and cold water mixing valves, Thermostat valves, Bid cocks pitometer valves, cherni keff leg valves, ventilation slide valves, Air Relief valves..
15. Principle and working of W.T. Doors, hatches side scuttles square ports, escape scuttles, manholes skylight and their associated arrangements ventilation flaps and Recirculating flaps.
16. Various types of lifting, appliances used in ships and crafts of Indian Navy e.g. Boat Davits, Ammunition derricks, cranes etc.
17. Detailed knowledge of various types of hull outfits fitted in Naval ships.
18. Manually operated pumps and winches.
19. Aircraft, lifts, Rocket and Bomb lifts, HP/DE Mast Aerials.

For Foreman & Asst. Foreman (Ship Fitter)

1. Detailed knowledge of hand tools and measuring instruments used in conjunction with metals and pipes.
2. Detailed knowledge of all types of drilling machines, Reamers, various fluids.
3. Detailed knowledge of use & principle of lathes, drilling, reaming, boring and thread cutting on a lathe, various types of threads and their applications.
4. Detailed knowledge of use and principle of milling machines and milling cutters etc.
5. Detailed knowledge of workshop machinery e.g. grinders, power hacksaw, pipe bending presses/machines etc.
6. Detailed knowledge of ships services e.g. F.W. service, Domestic service, Sanitary service, Pumping flooding & draining arrangements, Air escape arrangements, Voice and Message carrying pipes, Magazine spraying arrangements, Flooding cabinets.

7. Detailed knowledge of rod gearing used for control of various valves, Mitro wheels, Gear wheels, Ball bearings brackets, Universal joints and expansion coupling lock/arrangements.
8. Detailed knowledge of all types of valves fitted in various services and systems e.g. Sea cock, SDNR valve, SDNR Flood valves, DFS valve, sluice valve, Non return valve, SDNR flood storm valve, Reducing valve, Flushing valve, Hot & cold water mixing valve, Thermostat valves, Bid cocks, Pitometer valves, Charni keff log valves, ventilation slide valve, Air Relief valve.
9. Detailed knowledge of all types of W.T. Doors, hatches, side, scuttles, square ports, escape scuttles, manholes, skylights and their associated arrangements, ventilation flaps and Recirculation baffles.
10. Detailed knowledge of all types of lifting appliances used in ships and crafts e.g. Davits, Derricks and Cranes.
11. Detailed knowledge of various type of Hull outfits fitted in IN Ships.
12. Detailed knowledge of all types of manually operated pumps and winches
13. Detailed knowledge of Air craft lifts, Rocker and Bombs.
14. Detailed knowledge of the miscellaneous fitting, e.g. Telegraph countries. Revolution countries, Rolling shutters, steel & wooden Blocks, Accommodation ladder and boom fitting fairleads, Tripods, wire roles, Beat fittings, Blow lamps, lanterns, Fire Extinguishers, hydraulic jacks, spray painting guns etc.
15. Detailed knowledge of all types of mechanically operated steering arrangements of ship crafts and boats.
16. Detailed knowledge of valves, pipes and rod gearing fitted in caissons and Dockgates.
17. Detailed knowledge of relevant specifications of fasteners and jointing materials used in conjunction with various systems, services and fitting enumerated in the preceding paragraphs.
18. Detailed knowledge of specification of various materials used in fitting, services and systems, their composition test and application.

Part B**(C) SYALLBUS FOR TRADE TESTING EXAMINATION OF WELDER****For Foreman and Asst Foreman.**

1. Physical & Metallurgical properties of Welding materials. Structural steels: Stainless steel; and Copper alloys, Brasses, Bronzes, Aluminium Bronzes, Copper Nickel alloys, Joining & Hard Facing alloys; Engineering casting & Forgings. Adequate knowledge for welding Nickel alloys; Titanium & propeller alloys.
2. Welding Process Plants, Equipment, Tools & Accessories. Gas welding; Metal arc welding; Submerged arc welding; metal inert gas welding; Tungsten inert gas welding; Resistance welding; Machine stud welding, Electroslag welding; Friction Welding; Electron beam welding; Gravity welding; Ultra-sonic Welding; Brazing; Soldering; Metallizing; under water welding/cutting; Flame cutting; Back gauging.
3. Electrodes and Filter Wires. Electrodes cooling system.
Electrode Groups and their Characteristics: -
 - a) Ferrous. Ferritic; Austenitic; Chromium – Molybdenum; Nickel and nickel chromium alloy; Hard facing; Cast iron.
 - b) Non-Ferrous. Aluminium and Aluminium alloys; Aluminium bronze, Tin Bronze Titanium. Care and Storage of Electrodes and filler wires;
 - c) Baking of Electrodes.
4. Welding joints: -
 - a) Butt joint. Square butt, single V butt; Double V butt; Single U butt; Double U butt; Single leveled butt; Double leveled butt; Single J butt; Double J butt; Single level tee butt; Double level tee butt; single J tee butt; Double J tee butt.
 - b) Fillet Weld.
 - c) Lap joint.
5. Welding Position. Flat, Horizontal –Vertical up, Vertical down, Overhead.
6. Welding Procedure. Classification & size of electrodes, Current for automatic welding, lengths of pass per electrodes or for automatic welding, speeds of travel, Edge preparation, Number and arrangement of passes in multirun welds; welding position, welding sequence, preheating

- and post heating temperatures & means/mode of application, Back gauging and its procedure. Establishment of procedure; Assembly and welding sequence.
7. Symbols on Drawings for Engineering Purpose. Symbols indicating weld details conforming to B.S.S 499
 8. Weld Defects. Dimensional effects; Distortion, Incorrect edge preparation, Weld shape, porosity, Non-Metallic inclusion, incomplete fusion, Undercut, Cracks, Arc blow
 9. Repair of defective welds. Visual examination of faulty welds, Detection of Defect by visual examination classification of defect; Rectification of defect, Re-examination of rectified defect; surface finish of rectified defect.
 10. Standard of Workmanship Covering: - Preparation of materials, Welders capabilities and capacities; Weather conditions, preheating & post heating; Plant & equipment procedure, Assembly sequence, Welding conditions, Tack weld, Minor Welds, Deposits, Stray arcing, Back gouging, Cleaning between runs, Visual inspection, Surface finish of welds.
 11. Safety in welding :- Fire precautions; Storage & Handling of Gas Cylinders, Protection to personnel, protective clothing; Electric shocks, Burns, Eye injuries, Degreasing agents; Paint/Metallic coatings; Ventilation arrangements, safe for hot work procedures.
 12. Reinforcing Pitted Area. Application, preparation of surface to be reinforced, selection of welders. Instruction to welders. Welding technique, surface finishing of reinforced area, Examination of reinforced area.
 13. Corrosion Aspects of Welding. General aspects of self corrosion; Galvanic corrosion.
 14. Capacity of cables, Return leads; D.C. power sources in relation to one or more than one ship both alongside.
 15. Quality Control Non-destructive Examination & Acceptance :-
 - (a) Methods. Visual Magnetic particle; Liquid penetrant; Radiography, Ultrasonic.
 - (b) Selection of Method. Type of materials, thickness of material, joint geometry, Access, Surface condition, service condition, type of weld flow.
 - (c) Extent of N.D.E.
 - (d) Acceptance Standards.
 16. Welding rules as applicable to Shipbuilding.

17. Specifications. B.S.S./I.S.S. Specifications are applicable to welding trade.

For Chargeman-I (Welder)

1. Physical & Metallurgical properties of Welding materials. Structural steel: Stainless steel; Aluminium and Aluminium alloys; Copper and Copper alloys; Brasses; Bronzes; Aluminium Bronzes; Copper-Nickel Alloys; Joining & Hard Facing alloys; Engineering castings & forgings. Basic knowledge for welding Nickel alloys and Titanium.
2. Welding Process Plants, Equipment, Tools & Accessories. Gas welding; Metal arc welding; Submerged arc welding, Metal inert gas welding; Tungsten inert gas welding; Resistance welding; Machine stud welding, Electroslag welding; Friction Welding; Electron beam welding; Gravity welding; Ultra-Welding; Brazing; Soldering; Sonio Metallizing; Underwater welding/cutting Flame cutting; Back gauging.
3. Electrodes and Filter Wires. Electrodes Cooling system.

Electrode Groups and their Characteristics : -

- a) Ferrous. Ferritic; Austenitic; Chromium – Molybdenum; Nickel and Nickel Chromium alloy; Hard facing; Cast iron.
 - b) Non-Ferrous. Aluminium and aluminium alloys; Aluminium bronze, Tin Bronze; Titanium; Care and Storage of Electrodes and filler wires. Baking of electrodes.
4. Welding joints :-
 - a) Butt joint. Square butt; Single V butt; Double V butt; Single U butt; Double U butt; Single leveled butt; Double leveled butt; Single J butt; Double J butt; Single level tee butt; Double level tee butt; Single J tee butt; Double J tee butt.
 - b) Fillet weld.
 - c) Lap joint.
 5. Welding Position. Flat, Horizontal Vertical; Vertical-up; Vertical- down; Overhead.
 6. Welding Procedure. Classification and size of electrodes; Current and for automatic welding length of pass per electrodes or for automatic welding speed of travel; Edge preparation; Number and arrangement of passes in multirun welds; Welding position; Welding sequence; preheating and post heating temperatures and means-mode of application, Back gauging and

- its procedure. Establishment of procedure; Assembly and welding sequence.
7. Use of Symbols on Drawings for Engineering Purpose. Symbols indicating weld details conforming to B.S.S 499
 8. Weld Defects. Dimensional defects; Distortion; Incorrect edge preparation; weld size, weld shape; porosity; Non-Metallic inclusion; Incomplete fusion; Undercut; Cracks; Arc blow
 9. Repair of defective welds. Visual examination of faulty weld; Detection of defect by visual examination; Classification of defect; rectification of defect; Re-examination of rectified defect; surface finish of rectified defect.
 10. Standard of Workmanship Covering. Preparation of materials; Welders capabilities and capacities; Weather conditions; preheating & postheating; Plant & equipment procedure; Assembly; Sequence; Welding conditions; Tack weld; Minor Welds; Deposits; Stray arcing; Back gauging; Cleaning between runs; Visual inspection; Surface finish of welds.
 11. Safety in welding. Fire precautions; Storage & Handling of gas cylinders; Protection to personnel; Protective clothing; Electric shocks; Burns; Eye-injuries; Degreasing agents; Paint/metallic coatings; Ventilation arrangements.
 12. Reinforcing Pitted Area. Application; Preparation of surface to be reinforced; Selection of Welders; Instruction to Welders; Welding technique; surface finishing of reinforced area; Examination of reinforced area.
 13. Corrosion Aspects of Welding. General aspects of self corrosion; Galvanic corrosion.
 14. Capacity of cables; Return leads; D.C. power sources in relation to one or more than one ship berth alongside.
 15. Quality Control Non-destructive Examination & Acceptance: -
 - a) Methods. Visual magnetic particle; liquid penetrant; Radiography, Ultrasonic.
 - b) Selection of Methods. Type of Materials; Thickness of Material; Joint geometry; Access surface conditions; Service Condition; Types of Weld flow.
 - c) Extent of N.D.E.
 - d) Acceptance Standards.

For Chargeman –II (Welder)

1. Physical & Metallurgical properties of Welding materials. Structural steel: Stainless steel, Nickel and Nickel Alloys; Aluminium and Aluminium alloys; Titanium Copper & Copper alloys; Brasses; Bronzes; Aluminium Bronzes; Copper Alloys; Nickel Alloys; Joining & Hard Facing alloys; Superstern alloys; Engineering castings & Forgings.

2. Welding Process Plants, Equipment, Tools & Accessories. Gas welding Metal, arc welding; submerged arc welding, Metal inert gas welding; Tungsten inert gas welding; Resistance welding; machine stud welding, Alumine Thermic welding; Brazing; Soldering; Metallizing Flame cutting; Back gauging.

3. Electrodes and Filter Wires. Electrodes Cooling system. Ferrous electrode groups and their characteristics; Ferritic; Austenitic; Chromium – Molybdenum; Nickel and Nickel Chromium alloy; Hard facing; cast iron. Care & Storage of electrodes and filler wires. Baking of electrodes.

4. Welding joints :-

a) Butt joint. Square butt; single V butt; Double V butt; Single U butt; Double U butt; single leveled butt; Double leveled butt; single J butt; double J butt; single level tee butt; double level tee butt; single J tee butt; double J tee butt.

b) Fillet weld.

c) Lap joint.

5. Welding Position. Flat, Horizontal-Vertical; Vertical-up; Vertical down; Overhead.

6. Welding Procedure. Classification & size of electrodes; Current and for Automatic welding lengths of pass per electrode or for automatic welding speeds of travel. Edge preparation; Number and arrangement of passes in multirun-welds; welding position; welding sequence; preheating and heating temperatures & means mode of application, Back gauging Galgomy and its procedure; Establishment of procedure; Assembly and welding sequence.

7. Use of Symbols on Drawings for Engineering Purpose. Symbols indicating weld details conforming to B.S.S 499

8. Weld Defects. Dimensional effects; Distortion; Incorrect edge preparation; weld size, weld shape porosity; Non-Metallic inclusion; Incomplete fusion; Undercut; Cracks; Arc blow

9. Repair of defective welds. Visual examination of faulty weld; Detection of defect by visual examination, classification of defect; Rectification of defect; Re-examination of rectified defect; Surface finish of rectified Defects.

10. Standard of Workmanship Covering. Preparation of materials; Welders capabilities and capacities; Weather conditions; Preheating & Post heating; Plant & Equipment; procedure; Assembly sequence; Welding conditions; Tack welds; Minor Weld, deposits; Stray arcing Back gauging; Cleaning between runs; Visual inspection; surface finish of welds.

11. Safety in welding. Fire precautions; Storage & Handling of gas Cylinders; Protection to personnel; Protective clothing; Electric shocks burns; Eye injuries; Degreasing agents; Paint; Metallic coatings; Ventilation arrangements.

12. Reinforcing Pitted Area. Application; Preparation of surface to be reinforced; Selection of Welders; Instruction to Welders; welding technique; surface finishing of reinforced area; Re-examination of reinforced area.

Part B

(d) SYLLABUS FOR TRADE TESTING EXAMINATION OF PAINTER

For Foreman & Asst. Foreman (painter)

The candidate is to be fully conversant with and have detailed knowledge of the following: -

1. *Types of paints:-*

- (a) Weather work paints for paints for protection of superstructures against atmospheric corrosion and for decoration.
- (b) Interior fire retardant paints for cabin and deck interiors.
- (c) Non slip deck paints.
- (d) Anticondensation paints for use in humid conditions.
- (e) Protective coatings for light alloys.
- (f) Underwater anti corrosive paints.
- (g) Underwater anti fouling paints.
- (h) Boot topping paints.
- (i) All type of primers.
- (j) Miscellaneous paints for tank interiors, battery compartments cable lockers and machinery compartments.
- (k) Anti galvanic paints.
- (l) Lacquers.
- (m) High quality finishing paints.
- (n) Toxicity of paints.

2. **Classification and composition of paints:-**

(a) Classification.

- (i) Classification of paints in different categories depending on:
- (ii) composition (e.g. oil based, clearesinous, synthetic, epoxy based etc)
- (iii) Function
- (iv) Uses
- (v) Method of Application.

(b) Composition.

To have a detailed knowledge of the composition and the functions of each constituent in all the different types of paints.

3. **Schemes of paintings.** To have an intimate knowledge of the paintings schedules used for different compartments and locations, the requirement for each schedule.
4. **Application of paints:-**
 - (a) Means of applications.
 - (b) Limitations of various paints.
 - (c) Covering rates and estimation of paint film thicknesses.
 - (d) Evaluation of different paints, based on ease of application, covering rate cost effectiveness, shelf life and performance.
5. **Spray painting:-**
 - (a) Types of spray guns in use, their principles of operation, working pressures, nozzle types and sizes
 - (b) Requirements of paints for spray painting.
 - (c) Airless spray systems, advantages and disadvantages.
 - (d) Installed and portable spray painting system, methods of material handling, mixing, preheating, distribution and delivery.
 - (e) Spray painting enclosures, material handling of items to be sprayed, layout of spray painting shops, fume extraction units and ventilation systems.
6. **Specifications ;-**
 - (a) Detailed knowledge of specifications laid down for various types of paints.
 - (b) Detailed knowledge of allowable limits for composition, physical characteristics/ properties, colour fasteners, viscosity and the methods of testing each characteristics.
 - (c) Detailed knowledge of paint testing.
 - (d) Detailed knowledge of the methods of evaluating different paints conforming to specification.
 - (e) Detailed knowledge of Indian and International specification for Marine Paints.
7. **Surface Preparation.** To have a detailed knowledge of all facts for surface preparation including ;
 - (a) Necessity of surface preparation prior to Painting.
 - (b) Specifications laid down for prepared surfaces.
 - (c) Degree of surface preparation required for different paints/painting schemes.
 - (d) Effects of poorly prepared surfaces on paint systems.
8. **Methods of Surface Preparation :-**
 - (a) To have a detailed knowledge of the methods commonly used viz. chipping scraping, wire brushing by hydrodynamic washing, sand blasting, wet sand blasting grit/shot blasting, vacuum blasting, their relative merits and demerits.

- (b) Applicability of each method of different paint systems paint schemes.
- (c) To have detailed knowledge of the principles of operation of various machines used for surface preparation.
- (d) Evaluation of different machines and surface preparation system.
- (e) Production rates for each surface preparation system.

9. Brush Painting. To have a detailed knowledge of :-

- (a) Types of brushes in use, standard sizes and materials in their construction .
- (b) Indian specifications for all types of brushes in use for paintings.

10. Artist Painting. To have a detailed knowledge of: -

- (a) Colours and colour schemes.
- (b) Types of letter in - mechanical and optical spacings, standardised lettering schemes, Mechanical Engineering lettering.
- (c) Paints and materials used in artist painting, water colours, oil paints, types and varieties of brushes and other implements.
- (d) Stencils and stencil cutting.

11. Paint Manufacturing. To have a detailed knowledge of: -

- (a) Processes involved in manufacture of paints.
- (b) Quality control and testing of paints at various stages of manufacture.
- (c) Manufacture of various putties for marine application.

12. Adhesives. To be fully conversant with: -

- (a) Types of adhesives in use, basic formulation.
- (b) Application to different surfaces, uses and limitation.
- (c) Evaluation of different adhesives, and the basic tests involved.

13. Corrosion. To have a detailed knowledge of; -

- (a) Principle of marine corrosion.
- (b) Effects on paint systems.
- (c) Means of combating corrosion.
- (d) Development of anti corrosive paint systems.
- (e) Techniques for the preservation of hulls.

14. Masonry. To have detailed knowledge of: -

- (a) Materials used for deck coverings, their compositions, preparation and application.

- (b) Advantages and disadvantages of the different cements and composition in use.
- (c) Covering rates and thickness required.

15. Glass Reinforced Plastic and Fibre Glass. To have a detailed knowledge of :-

- (a) Application to ships' structures.
- (b) Materials used and methods of application.
- (c) Limitations and defects.
- (d) Methods of repair of GRP structures.
- (e) Construction techniques of GRP structures and boats.

16. Defects in Paints/Paint Schemes. To have a detailed knowledge of the various defects observed in paints and painted surfaces, their causes methods of prevention and remedies.

FOR CHARGEMAN-I (PAINTER)

The candidate is to have a detailed knowledge of the following :-

1. Types of Paints :

- (a) Weather work paints for protection of superstructures against atmospheric corrosion and for decoration.
- (b) Interior fire Retardant paints for cabin deck interiors.
- (c) Non slip deck paints.
- (d) Anticondensation paints for use in humid situations.
- (e) Protective coatings for light alloys.
- (f) Underwater anticorrosive paints.
- (g) Underwater anti fouling paints.
- (h) Boat topping paint.
- (i) All types of primers.
- (j) Miscellaneous for tank interiors, battery compartments, cable lockers and machinery compartments.
- (k) Anti galvanic paints.
- (l) Lacquers.
- (m) High quality finishing paints.
- (n) Toxicity of Paints.

2. Classification and Composition of Paints :-

(a) Classification. Classification of paints in different categories depending on :-

- (i) Composition(i.e. oil based, clearesionous, synthetic, epoxy based paints etc.)

- (ii) Function.
- (iii) Uses.
- (iv) Method of application.

- (b) Composition. To have a detailed knowledge of the composition and the function of each component in paints.

3. Schemes of Painting. Painting schedules used for different compartments and the requirements for each schedule.

4. Application of Paints :

- (a) Means of application.
- (b) Relative merits and demerits of different schemes.
- (c) Limitations of various paints,
- (d) Covering rates and estimates of paint fibre thickness.

5. Spray Painting :

- (a) Types of spray gun in use their principles of operations, working pressures, nozzle types and sizes.
- (b) Requirements of paints for spray painting.
- (c) Airless spray systems, advantages, and disadvantages.
- (d) Spray painting system – methods of pre-heating, material handling , and distribution, portable and installed systems, mixing of paints.

6. Specifications :

- (a) Basis of specification laid down for various types of paints.
- (b) Allowable limits for composition, physical characteristics, colour fasteners, viscosity.
- (c) Fundamentals of paint testing.
- (d) Basic evaluations of different paints conforming to specification.
- (e) Detailed knowledge of Indian and International specifications for Marine paints,

7. Brush Painting :

- (a) Type of brushes in use, standard sizes and materials used in their construction.
- (b) Detailed knowledge of Indian and International specifications for all types of brushes in use for painting.

8. Surface Preparation :

- (a) Necessity of surface preparation prior to painting.
- (b) Specifications laid down for prepared surfaces.

- (c) Degree of surface preparation required for different paints/painting scheme.
- (d) Effect of poorly prepared surfaces on paint systems.

9. Methods of Surfaces Preparation :

- (a) Methods commonly used - chipping, scrapping, wire brushing, hydrodynamic washing, sand blasting, wet sand blasting girt/shot blasting, vacuum blasting – their relative merits and demerits, and limitations.
- (b) Applicability of each method to different paint systems/paint schemes.
- (c) Detailed knowledge of the principles of working of various machines use for surface preparation.
- (d) Evaluation of different machines and surface preparations systems.

10. Adhesives :

- (a) Types of adhesives in use, basic formulation.
- (b) Applications to different surfaces, uses and limitations.
- (c) Evaluation of different adhesives, and the basic tests involved.

11. Paint Manufacturing :

- (a) Basic knowledge of process involved in manufacture of paints,
- (b) Basic knowledge of Quality Control and testing of paints at various states of manufacture.
- (c) Manufacture of varying putties for marine application.

12. Masonry :

- (a) Elementary knowledge of laying of cements and deck coverings.
- (b) Materials used for deck coverings, their composition and preparation.

13. Artistic Painting :

- (a) Basic knowledge of colours and colour schemes.
- (b) Lettering – types of lettering, mechanical and optical spacings, standardised lettering schemes, elementary knowledge of Mechanical Engineering lettering.
- (c) Elementary knowledge of paints and materials used in Artist painting and water paints, oil paints, types and varieties of brushes and other implements.
- (d) Stencil and stencil cutting.

14. Corrosion. A detailed knowledge of :-

- (a) Principles of marine corrosion.
- (b) Effects on paint systems.
- (c) Means of combating corrosion.
- (d) Development of anti corrosive paint systems for the prevention of corrosion.

15. Glass Reinforced Plastic. A detailed knowledge of :-

- (a) Application to ships structures.
- (b) Materials used and methods of application.
- (c) Limitation and defects.

16. Defects in Paints/Paint Schemes. A detailed knowledge of the various defects observed in paints and painted surfaces, their causes and methods of prevention.

FOR CHARGEMAN-II (PAINTER)

The candidate is to have a knowledge of the following :-

1. Types of Paints. A detailed knowledge of different paints in the following categories.

- (a) Weather work paints for protection of superstructure against atmospheric corrosion and for decoration.
- (b) Interior fire retardant paints.
- (c) Anti condensation paints for use in humid situations.
- (d) Protective coatings for light alloys.
- (e) Underwater anticorrosive paints.
- (f) Underwater anti fouling paints.
- (g) Boat topping paint.
- (h) All types of primers.
- (i) Miscellaneous for tank interiors, battery compartments, minesweeping gears, cable lockers and Machinery compartments.

2. Classification and Composition of Paints. To have a detailed knowledge of :

- (a) Classification. Classification of paints in different categories depending on :-
 - (i) Composition-oil based, clearsinous, synthetic, epoxy based paints.

- (ii) Function.
- (iii) Method of application.

- (b) Composition of paints: and the basic function of each component in paints.

3. Schemes of Painting. Painting schedules used for various compartments location of ships and the requirements for each schedule.

4. Application of Paints :

- (a) Means of application.
- (b) Limitations of various paints,
- (c) Covering rates of different paints.

5. Spray Painting. Types of spray guns in use and their principles of operation :

- (a) Basic knowledge of airless spray systems.
- (b) Basic knowledge of portable and installed spray painting system.

6. Specifications :

- (a) Basic specifications laid down for various types of paints.
- (b) Fundamentals knowledge of India and International specifications for marine paints,

7. Brush Painting :

- (a) Type of brushes in use, standard sizes and materials used in their construction.
- (b) Outlines of Indian and International specifications for all types of brushes in use for painting.

8. Surface Preparation :

- (a) Necessity of surface preparation and its significance prior to painting.
- (b) Basic knowledge of specifications laid down for prepared surfaces.
- (c) Degree of surface preparation required for different paints/painting schemes.
- (d) Effects of poorly prepared surfaces on paint systems.

9. Methods of Surfaces Preparation :

- (a) Basic knowledge of all surface preparation techniques commonly in use-their limitations, merits and demerits.

- (b) Applicability of each method to different paint systems/paint schemes.
- (c) Basic knowledge of the principles of operations of machines used for surface preparation.

10. Adhesives :

- (a) Types of adhesives in use.
- (b) Applications to different surfaces, uses and limitations.

11. Paint Mixing :

- (a) A Basic knowledge of mixing paints from given ingredients.
- (b) Basic knowledge of processes involved in manufacture of paints.

12. Masonry :

- (a) Elementary knowledge of laying of cements and deck coverings.
- (b) Materials used for deck coverings, their composition and preparation.

13. Artistic Painting :

- (a) Basic knowledge of colours and colour schemes.
- (b) Lettering – types of lettering, mechanical and optical spacing, standardised lettering schemes, elementary knowledge of mechanical Engineering lettering.
- (c) Elementary knowledge of paints and materials used in Artist painting, water and oil paints types and varieties of Brushes and other implements.
- (d) Stencils and stencil cutting.

14. Corrosion. An elementary knowledge of marine corrosions, its effects, principles and galvanic corrosion.

15. An elementary knowledge of application to ships structures materials used and methods of application.

16. Araldite To have detail knowledge of :

- (b) Application to ship structures
- (c) Materials used and method of application.
- (d) Limitations and defects.
- (e) Methods of repair

17. Defects in Paint/Paint Schemes. A detailed knowledge of the various defects observed in paints and painted surfaces, their causes and methods of prevention.

Part B**(e) SYLLABUS FOR TRADE TESTING EXAMINATION OF
SHIPWRIGHT**

In addition to the jobs required to be undertaken by supervisors of lower grade the supervisor must be capable of the following: -

For Foreman and Asst Foreman.

1. Train and guide supervisors of lower grade.
2. Should be able to communicate fluently in English and Hindi in all aspects of work with supervisors.
3. Should be able to forecast accurately annual requirements of materials required for the shop/centre and evolve a MSL for each item.
4. Should be able to monitor all the activities of the centre and correctly plan the workload in accordance with the work instructions issued by the planning department.
5. Should be very conversant with all conventional procedures adopted in various jobs of the shipwright like repair and manufacture of powered and non powered wooden boat, GRP boats tiling, insulations heat input test, wood conversion techniques docking/undocking, manufacture and laying of dark blocks, boat chocks, wooden sheaves, parts of boats, slipping/unslipping of boats, hoisting/lowering of boats, polishing of various structures, operation/maintenance routine of caissons/gates, types of shoring (breast shore / bilge shores / stem shores) marking of water lines / draught marks laying off for ships in Drawing office, load testing of appliances like davits, derricks, cranes, R.A.S, onboard ships/crafts etc.
6. Should be able to accurately derive specifications of various materials/end products.
7. Should be able to understand and appreciate the technical drawings/documents and various WLDs and be conversant with standard operating procedure for all jobs of shipwrights.
8. Should be totally aware of all machines, their maintenance routines and the various tools/portable machines and their usages.
9. Should be able to effectively inspect all types of materials used in shipwright trade.

10. Should have good knowledge in various methods of seasoning of wood, types of wood treatment, working of impregnation plants, and should be able to undertake inspection of wood.
11. Should have sound knowledge of operation and testing of material handling equipments like listers, fork listers, cranes and calibration of various measuring gauges/devices.
12. Should have sound knowledge of Naval architecture stability calculations, docking calculations and dock plan.
13. Should be thoroughly conversant with the latest techniques of GRP works, associated materials and associated intricacies.
14. Should be able to make an accurate time estimate of any task pertaining to shipwright trade.
15. Should have sound knowledge in ISO 9002 procedures and be able to undertake audit of an ISO 9002 certified centre.
16. Should have sound knowledge of safety practices at work and the associated safety gears/equipments.

SYLLABUS FOR CHARGEMAN-I (SHIPWRIGHT)

In addition to the jobs required to be undertaken by supervisors of lower grade the supervisor must be

Capable of the following: -

1. Train and guide supervisors of lower grade.
2. Should be able to communicate in English and Hindi in all aspects of work with supervisors.
3. Should be able to forecast annual requirements of materials required for the shop/centre and evolve a MSL for each item.
4. Should be able to monitor the activities of the centre and correctly plan the workload in accordance with the work instructions issued by the planning department.
5. Should be conversant with all conventional procedures adopted in various jobs of the shipwright like repair and manufacture of powered and non powered wooden boat, GRP boats, tiling, insulations, heat input test, wood conversion techniques, docking/undocking, manufacture and laying of dock blocks, boat chocks, wooden sheaves, parts of boats,

- slipping/unslipping of boats, hoisting/lowering of boats, polishing of various structures, shore/bilge shores/stem shores) marking of water lines/draught marks, laying off for ships in Drawing office, load testing of appliances like davits, derricks, cranes, R.A.S. onboard ships/crafts etc.
6. Should be able to derive specifications of various materials/end products.
 7. Should be able to appreciate the technical drawings/documents and various WLDs and be conversant with standard operating procedure for all jobs of shipwrights.
 8. Should be aware of all machines, their maintenance routines and the various tools portable machines and their usages.
 9. Should be able to inspect all types of materials used in shipwright trade.
 10. Should have knowledge in various methods of seasoning of woods, types of wood treatment, working of impregnation plants, and should be able to undertake inspection of wood.
 11. Should have knowledge of operation and testing of material handling equipments like listers, fork listers, cranes and calibration of various measuring gauges/devices.
 12. Should have knowledge of Naval architecture stability calculations, docking calculations and dock plan.
 13. Should be conversant with the latest techniques of GRP works and associated material and associated intricacies.
 14. Should be able to make time estimate of any task pertaining to shipwright trade.
 15. Should have sound knowledge in ISO 9002 procedures and be able to undertake audit of an ISO 9002 certified centre.
 16. Should have sound knowledge of safety practices at work and the associated safety gears/equipments.

SYLLABUS FOR CHARGEMAN-II (SHIPWRIGHT)

In addition to the jobs required to be undertaken by tradesman the supervisor must be capable of the following: -

1. Should be proficient in calculation of area, volumes, estimations of weights, materials, labour and time.
2. Should know the various types of wood used in ship repair and shipbuilding, their properties and uses.
3. Should know the different ferrous and non-ferrous materials used in wood working, their specifications and uses.
4. Should know the different tools for wood working and for repair of various wooden fittings on board ships and have a detailed knowledge of their uses, limitations, methods of sharpening and adjustment.
5. Should have a detailed knowledge of wood working shop practices, including basic knowledge of the method of operation of wood working machines and portable tools like band saw, jig saw, planners, thickness machines tenoning and mortising machines, drills, moulding machines, sanders, lathes, etc, and their maintenance.
6. Should have a detailed knowledge of different joints used in wood working and for manufacture/
repair of wood fittings used in ship building/ship repairs.
7. Should have a detailed knowledge of the different types of insulating materials used onboard ships their properties and applications.
8. Should have a detailed knowledge of all standard and non-standard wooden boats used in the Indian Navy, their sizes, weights, and methods of construction.
9. Should have a detailed knowledge of method of preparation of dry docks for docking, working from drawings, etc.
10. Should be capable of laying out a ship's plan on the mould loft floor, working from drawings, and capable of making templates either from drawing or from offsets obtained from the mould loft floor.

11. Should be capable of independently undertaken manufacture of various items from drawings.
12. Should know the operation of caissons, dock gates etc.
13. Should be capable of independently laying wooden docks, deck planking, and independently undertaking insulation of cold and cool rooms, ready use cool cupboards, decks, bulkheads etc., using approved insulating materials.
14. Undertake repair and manufacture of different types of standard and non-standard wooden boats used in the Navy.
15. Independently undertake building repair and erection of keel blocks, cradles, shoring, cribbing and other structures used for supporting ships in dry socks.
16. To be independently capable of estimating material requirements and laying various types of deck coverings onboard ships.
17. Should have detailed knowledge of lamination and bending of wood for fabrication of large section, type of glues used, curing times and temperatures, governing them.
18. Should be capable of independently undertaking manufacture of catamarans, rafts, floats, pontoons, masts, spares, ladders etc.
19. Should be independently capable of undertaking all repair of wooden hulls.
20. Should be capable of hoisting/lowering of all types and sizes of boats made of wooden/GRP/Steel hull.
21. Should be capable of undertaking copper sheathing of boats and ships.
22. Should be capable of undertaking caulking of boats, decks and hulls of ships.
23. Should have knowledge of preparation and application of different types of polishes and varnishes.
24. Should have a basic knowledge of sawmill conversion procedures and wood accounting.

25. Should have a good detailed knowledge on various methods of treatment of wood and be able to independently handle the wood impregnation plant.
26. Should have a detailed knowledge of the methods involved in testing various types of lifting appliances fitted on board ships, including knowledge of working loads and testing loads.
27. Should be able to independently repair, install and construct wooden furniture, paneling, doors, windows, benches, cupboards, portable wooden fittings either onboard ships or in the shop.
28. Should be able to independently repair/renew hinge posts, meter posts, sill bearers and platforms of dock gates and undertake caulking of all gates for water tightness.
29. Should be capable of independently construction of repairing or renewing of battle practice target, high-speed target etc.
30. Should be capable of independently repairing/renewing wooden bases, pads, chocks, racks, battens etc. Onboard ships and crafts.
31. Should be capable of independently checking and marking draught marks and waterlines of ships and crafts.
32. Should have a detailed knowledge on the various materials and procedures in the field of glass reinforced plastics.
33. Should be able to undertake survey of GRP structures by visual hammer ultrasonic technique and prepare a survey report.
34. Should be able to independently prepare the various resins (General purpose resin, epoxy resin and polyester resin) and undertake repair of sonar domes, shafts, dielectric shields, cable trays, gratings fairing of reference electrodes, ICCP anodes.
35. Should be able to repair hull of all types of GRP boats, collar plates, associated fittings and carry out leak checks.
36. Should be able to read and understand technical drawings and undertake building of GRP boats and wooden boats of all sizes.
37. Should have detailed knowledge of stores, accounting procedure of material and manpower, functions of the control cell and handling of Work Instructions.

38. Should have knowledge of role of the department and centres, types of assistance required for the job entrusted.
39. Train and grade all lower categories of tradesmen and labourers.
40. Should be able to read and write English/Hindi and be able to explain technical matters to supervisors as well as subordinate tradesmen.
41. Should be able to plan work for future estimate material requirements and exactly make a true estimate of any job.
42. Should be conversant of ISO 9002 procedures, and application of them in the centre.
43. Should be aware of the safety practices while undertaking work and safety gears/equipments.

Part B

(f) SYLLABUS FOR TRADE TESTING EXAMINATION OF TAILOR

In addition to the job required to be undertaken by supervisors of lower grade, the supervisors must be capable of the following: -

For Chargeman – I

1. Train and guide supervisors of lower grade.
2. Should be able to communicate in English and Hindi in all aspects of work with supervisors
3. Should be able to forecast annual requirements of materials required for the shop/centre and evolve a MSL for each item. .
4. Should be able to monitor the activities of the centre and plan the workload in accordance with the work instructions issued by the planning department.
5. Should be conversant with all conventional procedures adopted in various jobs of the sailloft, viz manufacture of flags/dressing lines/pennants/distant lines, Equipment/Weapon covers/ awings/ ceremonial awnings sails and manufacture of bunk mattresses, cushions, backrests, pillows with coir, upholstery of sofas, chair and settees and their cloth covers and cushion etc.
6. Should be able to derive specifications of various materials/end products.
7. Should be able to appreciate the technical drawings/documents and various WLDs and be conversant with standard operating procedure for all jobs of tailors.
8. Should be aware of all machines, the associated maintenance routines and the various tools, portable machines and all their usages.
9. Should be able to inspect all types of materials pertaining to tailor trade.
10. Should have knowledge of operation and testing of material handling equipments like listers, fork listers, cranes and calibration of various measuring devices/gauges.
11. Should be able to make a time estimate of any task pertaining to tailor trade.

12. Should have knowledge in usage of hot air welding machines and with PVC coated nylon fabric and associated maintenance routines.
13. Should have sound knowledge in ISO 9002 procedure and be able to undertake audit of an ISO 9002 certified centre.
14. Should have sound knowledge of safety practice at work and the associated safety gears/equipments.
15. If working in LRRC should be capable of the following: -
 - a) Should be conversant with the rules, regulation and procedures of servicing a life raft as per SOLAS.
 - b) Should be able to forecast the requirement of materials required in LRRC and be conversant with the various items used in the life rafts, and the demand procedures.
 - c) Should have knowledge of the storing/accounting procedures involved in ammunition stores like hand flares etc.
 - d) Should be able to repair/manufacture inflatable collars of all types and able to repair all types of fenders.
 - e) Should be able to repair all types of geminies, life jackets.
 - f) Should be aware of all types of life rafts in Indian Navy.

SYLLABUS FOR FOREMAN & ASST. FOREMAN (TAILORS)

In addition to the job required to be undertaken by supervisors of lower grade, the supervisors must be capable of the following: -

1. Train and guide supervisors of lower grade.
2. Should be able to communicate fluently in English and Hindi in all aspects of work with supervisors.
3. Should be able to forecast accurately annual requirements of materials required for the shop/centre and evolve a MSL for each item.

4. Should be able to monitor all the activities of the centre and correctly plan the workload in accordance with the work instructions issued by the planning department.
5. Should be very conversant with all conventional procedures adopted in various jobs of the sailloft, viz manufacture of flags/dressing lines/pennants/distant lines equipment/weapon covers/awnings/ceremonial awnings, sails and manufacture of bunk mattresses, cushions, backrests, pillows with coir upholstery of sofas, chair and settees and their cloth covers and cushions etc.
6. Should be able to accurately derive specifications of various materials/end products.
7. Should be able to understand and appreciate the technical drawings/documents and various WLDs and be conversant with standard operating procedure for all jobs of tailors.
8. Should be totally aware of all machines, the associated maintenance routines and the various tools, portable machines and all their usages.
9. Should be able to effectively inspect all types of materials pertaining to tailor trade.
10. Should have sound knowledge of operation and testing of material handling equipments like listers, fork listers, cranes and calibration of various measuring devices.
11. Should be able to make an accurate time estimate of any task pertaining to tailor trade.
12. Should have knowledge in usage of hot air welding machine and of with PVC coated nylon fabric, and the associated maintenance routine.
13. Should have sound knowledge in ISO 9002 procedure and able to undertake audit of an ISO 9002 certified centre.
14. Should have sound knowledge of safety practices and work and the associated safety gears/equipments.
15. If working in LRRRC should be capable of the following: -
 - (a) Should be thoroughly conversant with the rules regulation and procedures of servicing a life raft as per SOLAS.

- (b) Should be able to accurately forecast the requirement of materials required in LRRC and be thoroughly conversant with various items used in the life rafts, and the demand procedures.
- (c) Should have thorough knowledge of the storing/accounting procedures involved in ammunition stores like hand flares etc.
- (d) Should be able to repair/manufacture inflatable should be able to repair/manufacture inflatable collars of all types and able to repair all types of fenders.
- (e) Should be able to repair all types of geminies, life jackets.
- (f) Should be thoroughly aware of all the types of life rafts in Indian Navy.

SYLLABUS FOR TAILOR - CHARGEMAN-II

In addition to executive all work normally carried out by the tradesmen of lower grades, the supervisor must be able to carry out the following: -

2. Training guide and organise all lower categories of tradesmen and labourers.
3. Should be able to read and write English Hindi and be able to explain technical matters to supervisors as well as subordinate tradesmen.
4. Should be able to read and understand all manufacturing and fabrication drawings and maintenance manuals of all sewing equipment in the shop.
5. Should be able to plan work for future and project material requirements in advance.
6. Should have knowledge of mathematics to calculate and estimate material requirements.
7. Should have knowledge of the properties and behavior in usage of all fabrics, stuffing, materials, glues, etc.
8. Manufacture of covers of all kinds where a perfect fit is essential.
9. Measure, inspect and check work produced by tailor of lower grade for accuracy of dimensions, finish and correctness of process.
10. Operation, routine maintenance and minor running repairs to all sewing machines in the shop.

11. If working in LRRC, should be capable of: -
- (a) Receiving, pre-issue, inspection, testing, servicing and routines on the fabric portion of all life saving equipment independently.
 - (b) Undertaking independently, major repairs such as renewal of buoyancy chamber panels, canopy panels, complete inner and outer companies, outer sea floor, panels and arches of centre sheets and thwarts, towing bridle, tightening strap and the fabric in the vicinity of all other fittings in accordance with relevant B.R.'s.
 - (c) Execution of the detailed test procedure on completion of every repair and servicing job.
 - (d) Packing of all type of life rafts as per SOLAS regulations.

Part B**(g) SYLLABUS FOR TRADE TESTING EXAMINATION OF RIGGER****FOR FOREMAN & ASST. FOREMAN (Rigger)**

1. **Docking and Undocking:** Detailed knowledge of the preparation and procedure of docking/undocking all vessels as applicable in IN Docks. (Seamanship Manual volume III, chapter 13).
2. **Berthing:** Detailed knowledge of berthing all vessels, berthing hawsers, their types, sizes specification survey & test. (Seamanship Manual volume I, chapter 6, vol.II, chapter 5)
3. **Hurricane Hawser:** Detailed knowledge of hurricane hawsers, their types, sizes, specifications, survey& test, rigging and usage (Seamanship Manual vol I,chapter 6 vol. li, chapter 5)
4. **Fenders:** Detailed knowledge of all types of fenders their specifications of material, construction and suage (Seamanship Manual Vol I, chapter 6).
5. **Brows:** Detailed knowledge of all types of brows used in IN Docks, their construction and method of securing to ships.
6. **Capstans:** Detailed knowledge of capstans, their types, operation and use during the movement of ships.
7. **Basin Trails:** Detailed knowledge of the types of rigging and methods of securing for basin trails.
8. **Warping ships:** Detailed knowledge of warping ships as carried out in yards including the types, construction and specifications of the rigging used (Seamanship Manual Vol III chapter 13).
9. **Shop Mathematics:** Detailed knowledge of all calculations associated with rigging.
10. **Shop Machines:** Detailed knowledge of all machines in the shop, their operation, specifications, capabilities, spares requirement and maintenance.
11. **Rope and its usage:** Detailed knowledge of the following:

- (a) Construction and characteristics of vegetable fibre Cordage.
- (b) Construction and characteristics of Man made Fibre Cordage.
- (c) Construction and characteristics of wire ropes.
- (d) Handling of: -
 - (i) Vegetable Fibre Cordage
 - (ii) Man made Fibre Cordage
 - (iii) Wire ropes
 - (iv) Hawsers

(Seamanship Manual Vol. I, chapter 6)

- (e) Detailed knowledge of the following: -
 - (i) Type and characteristics of Cordage, special kinds of rope, small stutt spun yarn and House line, the manufacture of cordage supplied to the Service, and the specification Inspection and testing. Guidelines given in Seamanship Manual Vol ii, chapter V “General Remarks of Cordage”.
 - (ii) Special type of wire ropes, terminals flexibility of wire ropes, maintenance, Inspection and testing. (Seamanship Manual Vol II chapter V “General Reamrks on wireropes”.
 - (iii) Breaking stress of cordage, boltrope small stuff, wire rope Seamanship Manual Vol II,Chapter 5).
12. **Rope Work:** Detailed knowledge of rope work carried out in IN yards (Seamanship Manual Vol 1, chapter 7,Vol II, chapter V).
 13. **Masts:** Detailed knowledge of Masts and Spars and its associated rigging, their loads to which the rigging are tested and the method of testing.
 14. **Slings:** Detailed knowledge of the manufacture and specification of slings of all description undertaken by riggers, their loads under test conditions and the method of testing.
 15. **Rigging for Booms Davits and Derricks:** Detailed knowledge of all rigging for booms, davits, and Derricks, their manufacture, loads under test conditions and the method of testing.
 16. **Hand signals for Control of Cranes:** Detailed knowledge of cranes (Seamanship Manual Vol ii, chapter VI).

17. **A/C Arrester Wires:** detailed knowledge of: -
 - (a) A/C Arrester wires their specifications and loads under test condition.
 - (b) A/C Arrester wire socketing and the specification of associated parts.
 - (c) The process of manufacture of A/C Arrester wire socketing and the specification of materials used and their testing. (BR 3000 AND BR 3001).
18. **Test House Work:** Basic knowledge of the procedure followed for testing of various rigging in the test house and the operation of the machine.

FOR CHARGEMAN-I (Rigger)

1. **Docking and Undocking:** Detailed knowledge of the preparation and procedure of docking/undocking all vessels and crafts as carried out in IN Docks, structure and control of berthing party employed in docking/undocking.
2. **Berthing:** Detailed knowledge of berthing all vessels and crafts as rigging of the same on all types of vessels (Seamanship Manual volume I, chapter 6, vol.II, chapter 5)
3. **Hurricane Hawser:** Detailed knowledge of hurricane hawsers and rigging of the same on all types of vessels (Seamanship Manual vol I,chapter 6 vol. II, chapter 5)
4. **Fenders:** Detailed knowledge of all types, uses, and construction as used in IN Yards (Seamanship Manual Vol II, chapter 6).
5. **Gangways:** Types, uses and their rigging on various ships
6. **Dinghies:** Types and control of dinghy during ship's movement.
7. **Capstans:** Detailed knowledge of manning and operation of capstans during docking, undocking, berthing, and tying up ships.
8. Detailed knowledge of securing ships for basin trials and organizing the securing of ships for this purpose.
9. **Warping ships:** Detailed knowledge of warping ships as carried out in IN yards (Seamanship Manual Vol III chapter 18).

10. **Shop Mathematics:** Detailed knowledge of ship mathematics (Seamanship Manual Vol II Appendix II).
11. **Shop Machinery:** Detailed knowledge of all shop machinery their capacity and specification.
12. **.....Ropes:**
 - (a) Detailed knowledge of construction and handling of Vegetable fibre, cordage man fibre, wire ropes and hawsers (Seamanship Manual Vol I, Chapter 6).
 - (b) Types and characteristics of cordage special kind ropes, small stuff, spun yarn and house line, manufacture, specification, inspections and testing of cordage (Seamanship Manual Vol II, chapter 5).
 - (c) Special types of wire ropes, terminals, flexibility of wire ropes, factor of safety, sheaves of wire ropes, maintenance, inspections and testing of wire ropes (Seamanship Manual Vol II, chapter 5).
 - (d) Breaking stress of cordage, bolt rope, small stuff and wire ropes (Seamanship Manual Vol II, chapter 5).
13. **General Rope Work:** Detailed knowledge of seizing, advanced splicing of cordage: working, parceling and serving, knots and general advanced work in cordage, splicing wire ropes (Seamanship Manual Vol I, chapter 7; Vol II, chapter 8).
14. **Masts and Spares:** Detailed knowledge of Masts and spares and their associated rigging (Seamanship Manual Vol I, chapter 8).
15. **Slings:** Detailed knowledge of the manufacture, specifications and testing of slings of all descriptions undertaken by the riggers.
16. **Booms and Davits:** Detailed knowledge of all rigging associated with booms and davits, their manufacture and testing.
17. **Cranes:** Detailed knowledge of signals for working cranes.
18. **A/C Arrester Wire Socketing:** Detailed knowledge of specification, manufacture and testing of A/C Arrester wires (BR 3000 and BR 3001).

FOR CHARGEMAN-II (RIGGER)

1. **Docking and Undocking:** Basic knowledge of docking and Undocking all vessels, detailed knowledge of hawsers and their handling during/undocking procedure followed in IN Dockyards for docking/undocking, basic knowledge of preparation of springs and guys, signals for working hawsers and capstans.
2. **Berthing:** Basic knowledge of berthing all vessels movement of catamarans, pontoons and caissons, structure and control of berthing party banding of hawsers as described in seamanship Vol II Chapter V.
3. **Hurricane Hawser:** Rigging of hawsers on a vessel, Basic knowledge of construction of hurricane hawsers (Seamanship Vol I,chapter 6 vol. II, chapter 5)
4. **Fenders:** Types and uses, as employed in IN Yards.
5. **Gangways:** Rigging of gangways on all vessels.
6. **Dinghies:** Use and control of dinghy during ship's movement.
7. **Capstans:** Basic knowledge of method of using capstans for docking, undocking, berthing, and tying up ships.
8. **Basin Trials :** Basic knowledge method of securing ships for basin trials.
9. **Warping ships:** Basic knowledge of methods as carried out in IN yards (Seamanship Manual Vol III chapter 18).
10. **Shop Mathematics:** Simple calculations of shop mathematics (Seamanship Manual Vol VI Appendix II).
11. **Shop Machinery:** Basic knowledge of all shop machinery and operation.
12. **Ropes:** Basic knowledge of construction and characteristics of vegetable fibre cordage, man made fibre cordage and wire ropes, Handling of all types of cordage, wore ropes and hawsers. (Seamanship Vol. I Ch.)
13. **General Rope Work :** Seizing advanced splicing of cordage, worm-parceling and serving, Knots and general advanced work in cordage, splicing wire ropes.

14. **Masts:** Basic knowledge of masts and spars, their associated rigging and attachments (Seamanship Vol. I Chapter 8).
15. **Slings** : Basic knowledge of the manufacture of slings of all descriptions undertaken by riggers and elementary knowledge of their testing.
16. **Booms and Davits** : Basic knowledge of all rigging, their manufacture and testing.
17. **Cranes** : Basic knowledge of signals for working cranes (Seamanship Manual Vol II. Chapter 6).
18. **A/C Arrester Wire Socketing:** Elementary knowledge of procedure and specification for socketing of A/C arrester wires (BR 3000 and BR 3001).

MAINTENANCE

Part – A – Common Syllabus for All Maintenance Trades

Note :- A meaning of the symbols used in syllabus for the knowledge expected from the various categories is as follows: -

- A - Complete understanding of the subject
 B - Good knowledge of the subject
 C - Working knowledge of the subject

Standard of knowledge
 required for promotion to

<u>SNo</u>	<u>Subject</u>	<u>F/M</u>	<u>Asst F/M</u>	<u>C/M-I</u>	<u>C/M-II</u>
01.	Safety and use of equipment				
	a) Cleanliness of working area	A	A	A	A
	b) Fire and safety precautions	A	A	A	A
	c) Hand fire fighting Appliances	A	A	A	A
	d) First aid	A	A	A	A
02.	Administration				
	a) P forms, K forms accident report forms	A	A	A	B
	b) Action in case of an accident	A	A	A	A
	c) Procedures for demanding spares materials	A	A	A	B
	d) Procedure for requisitioning cranes, Lister, Lighting connections	A	A	A	A
	e) Procedure for requisitioning ATM(M) departments assistance in shop maintenance	A	A	A	B
03.	Man Management	A	A	A	B
04.	Work planning	A	A	A	B
05.	Establishment organization	A	A	A	A
06.	Availability of skilled manpower	A	A	A	B
07.	Preventive measures and importance of personnel and public hygiene	B	B	B	C

08.	Workers education	A	A	A	B
09.	Discipline, entertrainer in higher production and greater efficiency. Code of discipline and code of conduct.	A	A	A	B
10.	Productivity – Its meaning and impotence	B	B	B	C

Part B

(a) **SYLLABUS FOR TRADE TESTING EXAMINATION OF *MILLWRIGHT***

For Foreman & Asst. Foreman (Millwright)

The syllabus of Foreman & Asst. Foreman (Millwright) is that of Chargeman-I and Chargeman-II (millwright). In addition he must know alignment of machine tools after overhaul.

For Chargeman-I (Millwright)

1. Syllabus of Chargeman-II (Millwright).
2. Workshop calculations; calculation of safe working loads, further problems to determine forces acting on shear legs, trusses, levers etc.
3. Preparation of Estimates for various types of repair work.
4. Further calculations on work, power, and energy related to the trade.
5. Foundation Drawing –Study and practical implementation.
6. Lay out drawings for installation of machines and equipment.
7. Drawings of lubrication and cooling systems.
8. Trade Theory—Types of clutches and methods of adjustment, lubrication systems, cooling systems, Maintenance of pumps, defects and their rectification.
9. Hydraulic and pneumatic mechanism.
10. Methods of repair—Factors affecting choice.
11. Use of reference books, tables and other useful data.
12. Instructions to work Study work simplification Basic approach.
13. Preventive maintenance—Importance of regular servicing. Preparation of maintenance schedules, and maintenance of log cards records.
14. Inspection of new machines and plants.

For Chargeman-II (Millwright)

1. **Workshop Calculation.** Applied workshop problems involving multiplication and division common fractions—Decimals, Metric system, square root percentage and its application, algebra, mensuration Geometry, Trigonometry, Logarithms, Graphs.

Calculation : A speed and feed, feed calculation, Taper and offset calculation. Calculation of speed of pulley and gear and determination of sizes for transmission. Simple calculation on work, power energy.

2. **Workshop Science.** Properties and uses of Ferrous and Non-Ferrous metals. Meaning of tenacity, Elasticity malleability—Properties of matters. Unit of mass. C.G.S. MKS and F.P.S. System of units. Factor of safety and different types of stresses. Mechanical advantage.

Machines—Determination of velocity, Ratio—Mechanical advantage and efficiency of which, pulley blocks, wheel and axle.

3. **Engineering Drawings.** Free hand sketching—views of simple hollow and solid bodies. Use of drawing instruments.

Simple isometric drawings.

4. **Trade Theory :**

- (a) Fitters Job-Hand Tools, marking out, filing, fastener, and their use. Drilling Reaming, scrapping, lapping soldering, fits limits.
- (b) Lathe, Milling, Boring, Drilling, Grinding Operations, their description and functions
- (c) Friction and Lubrication—Methods of Lubrication, Lubricating materials, Lubricating device.
- (d) Machine Parts—Levers, Pulleys, Gears, their description and function.
- (e) Shaft and shaft coupling—alignment of Shafts.
- (f) Types of drives—Belts V—Rope, Chain, Gears.
- (g) Transmission of powers.
- (h) Running repair including 'First Aid' for Machines.

5. **Trade Theory:**

- (a) **Foundation of Machines.** Safe load and excavation. Types of foundation—solid and reinforced concrete, steel and timber, types of vibration, their causes and prevention. Fixing machines to foundations, Heavy hammer Foundation, Heavy Impact Equipments.
- (b) **Erection of Machines.** Method employed, Precautions to be taken in aligning and leveling, special precautions necessary for precision machines, Erection of power hammers furnaces and chimneys special processes involved. Testing for correct functioning.
- (c) **Overhauling of Machines.** Precautions to be taken in dismantling, Sequence of operations, and marking of parts correct methods of

cleaning, Materials used for cleaning their names, specification and application. Reassembly of machines in correct sequence. Testing for correct functioning.

6. Safety precautions to be followed in the shop.
7. **Fire precautions.** Causes and types of Fires—Precautions against outbreak of fire—Fire Extinguishers---types and uses.

Part B**(c) SYLLABUS FOR TRADE TESTING EXAMINATION OF
CIVIL MAINTENANCE**

1) Definition

Technical Terms	: Knowledge about drg, instrument and standard sizes of drgs. Bldg. component like walls, doors, windows, column, piers etc.
Bldg. construction	: Masonry walls (bricks, stone, hollow block) Doors/window frames (wood, steel, and aluminum) Arches Skirting/dado Collar truss and roof covering.
Bldg. material	: Brick Stone Timber Roof covering Cement
Specification	: Plaster mix (cement/lime) Timber Builder's hardware Glass
Sketching & Designing	: Single storey Bldg. Residential/non residential, working out sketch, plan, elevation and section. Furniture lay out of drg room, bedroom and dining room.
Roads	: Construction and maintenance
Water supply & Sanitary	: water supply and sanitary engineering.
Wharfs & jetties store	: Maintenance of wharf & jetties. : Store procedure.
MSE	MES work procedure.

Part B**(c) SYLLABUS FOR TRADE TESTING EXAMINATION OF CRANE FITTER (ICE)**

SNo	Subject	C/M-II
01	Refitting and Routing maintenance of Mobile Cranes (Diesel driven) portal cranes and other mobile equipments such as Platform trucks, Tractors, HP, LP compressors, Generators and SBK equipments	A
02	Knowledge of various Diesel Engines, Fuel pumps, Associated general inches etc	A
03	Undertake responsibility for major overhaul of Mobile and Portal cranes and other Mobile equipments	A
04	Dismantling, Assembling of Diesel engines and Portal crane parts and components and Gauging of moving parts	A
05	Grinding valves, valve, seats, Filling of Cylinders, Hand assemblies	A
06	Normal; precautions taken before starting of any engine or crane	A
07	Repairs of transmission gears, tyres and tubes	A
08	Examine of pulles and associated ball/roller bearing	A
09	Knowledge of functioning of limit switches, electromagnetic brakes, hydraulic brakes, pneumatic brakes dismental, refit and setting them	A
10	Knowledge of various kinds of greases, lubricants used on cranes and places they are used	A
11	Maintenance of chassis and super structures of cranes	A
12	Knowledge of hydraulic system of hydraulic mobile cranes	A

NOTE: - The meaning of the symbols used through regarding the standard of knowledge expected from the various grades is as follows: -

- A) - Complete understanding of the subject.
- B) - Good knowledge of the subject.
- C) - Working knowledge.

SYLLABUS FOR C/MAN-I = CRANE FITTER (ICE)

IN ADDITION TO THE SYLLABUS OF C/MAN-II = CRANE FITTER (ICE)

A Chargeman-I must be well versed with the following:

Preventive and Breakdown Maintenance and repairs to all the Mobile cranes, IC Engines, portal cranes, compressors, Tractors, DIA's, SSK, EQPA, FORK LIFT, ROAD ROLLER & TRUCKS, TRAILERS.

Must be able to plan and execute the major overhauls of IC Engines, Mobile and Portal Cranes, Tractors and platform Trucks etc.

Must be able to prepare maintenance schedule and draw bills of material.

Must be very familiar with various inspection, routines of IC Engines and be able to carry out the inspection of crane, IC Engines, wire ropes, Tyres etc.

Must be able to carry out the test of all mobile equipment including brakes and Hydraulic equipments.

Must be able to maintain Engine running logbooks maintenance and load testing records of all equipments.

Must be familiar with various regulations and orders regarding the operation of mobile cranes, Tractors, portal cranes, stores & safety.

To ensure the safety regulation in his section are enforced properly.

Must have knowledge of planning and must be able to plan his jobs prepare bills of materials and execute his work within the budgeted cost.

Must know Board proceedings for BER machine and receipt of new ones.

Must be able to inspect incoming store, materials, spare parts personally to ensure quality and suitability.

Investigate and make appropriate recommendation for minor disciplinary matters to senior foreman.

SYLLABUS FOR ASSISTANT FOREMAN & FOREMAN- CRANE FITTER (ICE)

IN ADDITION TO THE SYLLABUS OF C/MAN-I = CRANE FITTER (ICE)

A Assistant Foreman & Foreman must be familiar with the following:

1. Must be able to take charge of the whole shop i.e. all the equipments in the shop including portal cranes, Mobile Cranes, platform Trucks, Air compressors, Tractors, etc and the workers and Supervisors.
2. Must be able to ensure efficient performances of all the equipments in the shop.
3. Must be able to render efficient services of cranes and other Mobile equipments to all shops and ships with the zone prescribed.
4. Must be familiar with all the Safety Rules of workmen and supervisors, discipline and welfare measures and training etc.
5. Must be familiar with all the Safety Rules and Regulations Fire fighting and preventive methods crane operative Rules and Regulations etc.
6. Must be able to undertake periodic routines of maintenance and major overhauls of all the equipments under the charge and have the equipment operationally efficient.
7. Must be able to train his subordinates to assume higher responsibilities.
8. Must be able to ensure that the work is carried out within the budgeted cost (Estimate) & period.
9. Must be able to study all relevant statics and control information and take actions as necessary.
10. He must undertake important and heavy loads are handled his direct guidance and with adequate supervisors.
11. Must be able to ensure that all records of maintenance, schedule, Load testing, store, V.D.R.A.P.L.L store are maintain properly.
12. He must plan the requirement of stores and spares well in advance and ensure their availability.

13. He must maintain general discipline and liaison with shop committee representatives for improvement of working condition etc in the shop.

Part B

(d) **SYLLABUS FOR TRADE TESTING EXAMINATION OF PP&C**

<u>Subject</u>	<u>C/M-II</u>	<u>C/M-I</u>	<u>ASST.F/M</u>	<u>F/M</u>
1. Organisation of Naval Dockyard	B	B	A	A
2. Functions of various department of Dockyard	B	B	A	A
3. Organisation of planning Division	A	A	A	A
4. Functions of Planning Departments	B	B	A	A
5. Planning control Techniques- PERT, CPM, GNATT chart, Bar chart, PARATO chart	C	C	B	B
6. Management Information System	C	C	B	B
7. Material Management	B	B	A	A
8. Industrial Engineering	C	C	B	B
9. Dockyard Resources & Facilities	B	B	A	A

Legend

A – Complete Knowledge

B – Fair Knowledge

C – Working Knowledge

SECTION – C

SOFT SKILL DQE SYLLABUS FOR FOREMAN

UNDER FOUR TIER STRUCTURE

(IN ADDITION TO THE TRADE SYLLABUS)

(The subjects/topics are broad based & the actual question must be based on ground managerial skills & not the theoretical aspects.)

1. Roles and Responsibility of Supervisor.

- (a) Supervision, Role of the supervisor
- (b) Responsibility in relation to Subordinate
- (c) Responsibility in relation to Superiors
- (d) Responsibility in relation to Associates
- (e) Responsibility in relation to work

2. Interpersonal Relations and Communication.

- (a) Understanding the determinants of interpersonal behaviour
- (b) Self concept, misperception, selective interaction and evaluation of self
- (c) Interpersonal needs
- (d) Developing interpersonal relation
- (e) Developing mutual expectation
- (f) Honouring psychological contracts
- (g) Increasing interpersonal awareness- the Johari window
- (h) Purpose of communication
- (k) Importance of communication
- (m) Communication process
- (n) Art of listening
- (p) Expression (verbal-nonverbal)
- (q) Formal communication & Informal communication
- (r) Barrier to effective communication
- (s) Effective Communication

3. Motivation.

- (a) Issues in Managing People
- (b) Hierarchy of human needs
- (c) Maslow's need theory
- (d) Creating proper motivational climate

- (e) Future motivating factors
- (f) Sense of Identity
- (g) Sense of importance
- (h) Sense of development

4. Team building & Group Dynamics.

- (a) Team
- (b) Characteristic of effective team
- (c) Model of team building
- (d) Strategies to work in a successful team
- (e) Goal setting, contracting, mobilizing, monitoring & control, binding together
- (f) Factors responsible to keep high team spirit

5. Industrial Relations.

- (a) Purpose of Industrial relations
- (b) Development of Healthy Labour – Management relations
- (c) Maintenance of Industrial Peace
- (d) Industrial Democracy
- (e) Procedure of Discipline, Misconduct and Grievance
- (f) Factory Act and Provident Fund Act

6. Productivity.

- (a) Different elements of Productivity
- (b) Product Research and development
- (c) Layout of production system
- (d) Improving Work Methods
- (e) Inducting Quality control in Production
- (f) Material Handling - Raw material and disposal of finished goods

7. Leadership and Leadership styles.

- (a) Definition and Role of leadership.
- (b) Concept of leadership
- (c) Process of leadership
- (d) Function of leadership
- (e) Function for task need, group needs, individual needs
- (f) Leadership style: Autocratic, Democratic, Free rein of lassie & faire
- (g) Empowering Staff

8. Conflict Management,

- (a) Process of conflict
- (b) Stages of conflict
- (c) Type of conflicts

- (d) Perceived, Latent, manifest line and staff conflict
- (e) Organized and unorganized conflict
- (f) Interpersonal conflict
- (g) Strategies for conflict management

9. **Managing Stress and Anger.**

- (a) Different source of developing Stress
- (b) Different source of developing Anger
- (c) Development of Stress at work place, family and society
- (d) Effect of stress on health, attitude and progress
- (e) Management of Stress
- (f) Treatment to type of angers like violence, fighting, tantrum and damaging

10. **Time Management.**

- (a) Importance of Time Management
- (b) Time wasters related to managerial function
- (c) Planning, Organising, Directing, Communicating
- (d) Controlling and Decision Making
- (e) Boss imposed time, system imposed time, self imposed time
- (f) How to use time efficiently and effectively
- (g) Aids for time management
- (h) Technologies, day planner, concentration, strategies for time management.

11. **Computers**

- (a) Overview
- (b) Fundamentals
- (c) Data, Processing, information and stories
- (d) Windows 98 and Window 2000
- (e) MS Office, how to work
- (f) Bilingual Software
- (g) Internet
- (h) LAN

12. **Management of change**

- (a) Organisation transformation – Need
- (b) Resistance to change
- (c) Reducing Resistance to change
- (d) Strategies for sustaining change
- (e) Bench marking
