FN-5

NOTES BY TABISH SAYYED

* **POINTS TO REMEMBER :-**

⇒ REVISE ATLEAST 3-4 TIMES BEFORE ORAL READING ONCE WILL NOT WORK.

⇒ USE HIGHLIGHTER IT IS 'MANDATORY' WHILE REVISING NOTES.

⇒ REVISE LATEST SURVEYOR QUESTIONS {MOST RECENT ONE} 'VVIMP' NOT OLD PDF.

⇒ FOR MACHINERY TROUBLESHOOTING / WORKING WATCH VIDEO ON YOUTUBE FOR BETTER UNDERSTANDING.

⇒ THIS NOTES PREPARED BASED ON MOST RECENT QUESTION ASKED BY SURVEYOR & ALL ANSWER ARE SURVEYOR ACCEPTED.

⇒ THIS IS MOST UPDATED NOTES PREPARED BY FOLLOWING CONTENT FROM AUTHENTIC SOURCES SO 'SHARE TO ALL OF YOUR FRIENDS'.

⇒ REMEMBER THIS NOTES ONLY FOR ORALS NOT FOR WRITTEN.

⇒ BEFORE ORAL CHECK QUESTIONS OF SURVEYOR WHOSE NAME MENTION IN MAIL, REFER GOOGLE DRIVE LINK FOR SURVEYOR WISE QUESTIONS.

— X — BEST OF LUCK FOR ORALS — X —

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124 FNS :- * Electrical, Electronics & Control engineering at operational level {EECEOL}

What is slip? Synchronous speed formula?

⇒ Slip is the difference between the speed of magnetic field & the rotor's speed. It is essential to produce torque. It is measured as % of synchronous speed. It's value is always less than 1.

⇒ Synchronous speed = $N_s = \frac{120 \times f}{P}$ ← f: Frequency, P: No of poles

What is open circuit fault? What is overload trip?

⇒ An open circuit fault occurs when circuit is interrupted due to failure of ~~electrical~~ current carrying wire.

Open circuit fault can occur due to melting of fuse, failure of one or more phases, Joint failures of cables.

⇒ An overload trip deactivates electrical power to circuit to prevent possible damage when excessive current is flowing.

There are two types of overload trip :- Thermal overload relay & Magnetic overload relay.

If motor is running in low voltage which safety is there?

⇒ Under voltage protection relay.

Low voltage protection device.

If pole changed what will happen in alternator?

⇒ Change in output voltage. Change in output frequency. Unbalanced output. Reduced in output power.

⇒ Pole change can occur due to short circuit, overloading, maintenance errors

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How to improve power factor?

⇒ Static capacitor

⇒ Synchronous condenser :- When motor operates at no-load & over-excited it is called Synchronous condenser.

⇒ Phase advancer.

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Alternator all safeties? *

⇒ Under voltage / over voltage relay.

⇒ Under ~~or~~ frequency / over frequency relay.

⇒ over current relay.

⇒ Reverse power relay.

⇒ Earth leakage relay.

Alternator trips :-

⇒ Under voltage trip.

⇒ Over current trip.

⇒ Reverse power trip.

Q7) MSB safeties?

According to SOLAS Chapter 2-1, part D regulation 45 & 41.

⇒ Minimum 15 mm thick non-conducting Rubber mat should be in front & back side of MSB.

⇒ MSB should be 0.6m away from bulkhead.

⇒ Insulated hand gloves & hand rails should be provided.

⇒ Earth fault indications should be there on switchboard with 220V & 440V both with a test switch.

⇒ Portable CO_2 extinguisher shall be kept near MSB.

⇒ Test switch must be given for checking the lamp on MSB.

⇒ Tag must be posted for High voltage with sign of danger.

⇒ Fuses & circuit breaker should be there.

⇒ Surrounding should be free of any flammable material.

⇒ No pipelines should be nearby MSB.

Q.8) Insulation mat thickness & Class of mat?

⇒ Minimum 15 mm & Class 'C' {Not sure}

Q9) Emergency battery SOLAS regulations? {Chapter name don't know}

⇒ They should normally be located above waterline.

⇒ They should not be located ~~of~~ forward of the collision bulkhead.

⇒ They should be located in compartment that is outside & away from engine room.

⇒ The compartment should be accessible from open deck.

⇒ The system should be capable of ~~starting~~ operating with a list of 22.5° & trim of upto 10°.

⇒ Emergency battery shall not be located in the same space as the emergency switchboard.

⇒ They should ~~take~~ carry emergency load throughout the discharge period without being recharged or without it's voltage changing more than 12%.

Q10) Location of Emergency battery room & Emergency generator room?

⇒ Emergency battery room located on ~~back~~ Aft side of wheelhouse on open deck.

⇒ Emergency generator room located on main deck outside of engine room.

Q11) Power supplies given by emergency generator?

⇒ Emergency fire pump

⇒ Emergency air compressor

⇒ Emergency lights.

⇒ One steering gear motor.

⇒ One E/R vent fan.

⇒ Navigation equipment.

⇒ Communication equipment.

⇒ Fire detectors.

⇒ Lifeboat davit.

⇒ Battery charger.

Q12) How emergency generator is started? SOLAS regulations for starting?

⇒ The emergency generator on ship is typically started automatically upon loss of main power through a backup power system.

⇒ SOLAS regulations of 42 for passenger ship & 43 for cargo ship in chapter 2-1.

⇒ Flash point of fuel shall not be less than 43°c

⇒ Should able to start automatically after failure of main source of power supply within 45 seconds & it's rated load.

⇒ It should be started at 0°c or should have heating arrangement.

⇒ It should able to start at 10° trim & 22.5° list.

⇒ It should have atleast two independent source of starting. Both of them should able to ~~start~~ provide at three consecutive starts.

Q13) How many cells in 12V battery?

⇒ It consist of 6 cells each with a nominal voltage of 2V.

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Q14) Generator voltage fluctuation reason?

⇒ Load changes.

⇒ Excitation system.

⇒ AVR malfunction.

⇒ Winding faults.

⇒ Bearing or mechanical issues.

⇒ Maintenance neglect.

Q15) Where thermistor used & working?

⇒ A thermistor is a type of resistor which change it's electrical resistance with respect to change in temperature.

⇒ The material has a high resistance at low temperature & low resistance at high temperature.

⇒ Types of thermistor are:- PTC {positive temperature coefficient} T↑, R↑ & NTC {Negative temperature coefficient T↑, R↓}

⇒ Thermistor used on ship:-

⇒ Main engine & Generator temperature monitoring {oil, coolant or exhaust}

⇒ Bearing & Gearbox temperature monitoring.

⇒ Fire & heat detectors.

⇒ Air conditioning & Refrigeration temperature monitoring.

⇒ Pump bearing temperature monitoring.

⇒ Temperature monitoring of fuel & cargo tanks.

Q16) How lead acid battery works?

⇒ Lead acid battery consist of series of +ve & -ve plates. Each +ve & -ve plate form a cell. +ve plate which is cathode made up of Lead peroxide (P_bO_2) & -ve plate which is anode made up of lead (Pb).

⇒ Both plates are placed in a ~~Hydro~~ sulphuric acid SO_4 electrolyte solution with a separator in between. The electrolyte solution is a mixture of water & sulphuric acid (H_2SO_4) and ratio of 1:3.

⇒ During discharging process, At cathode:-

$PbO_2 + 2H + 2e \rightarrow PbO + H_2O$.
$PbO + H_2SO_4 \rightarrow PbSO_4 + H_2O$ } Cathode

At Anode:-
$Pb + SO_4 \rightarrow PbSO_4 + 2e$

⇒ During charging process, At cathode:-

$PbSO_4 + SO_4 \rightarrow PbO_2 + H_2SO_4$

At Anode
$PbSO_4 + H_2 \rightarrow Pb + H_2SO_4$

Q17) What is Electrolysis?

⇒ The electrolysis process in a battery refers to the decomposition of electrolyte into it's Constituent elements water, Hydrogen & oxygen.

⇒ This happen when an electric current pass through the electrolyte causing water to split into Hydrogen (H_2) & oxygen (O_2).

Q18) How Bus bar is placed? Function of Bus bar?

⇒ Bus bar is placed in top or bottom of switchboard connecting multiple vertical bus bar providing electric current to flow between different section of switchboard.

⇒ It is supported by insulated bracket to hold the bus bar in place.

⇒ Function of Bus bar:-

⇒ Power distribution.
⇒ Voltage distribution.
⇒ Current carrying.
⇒ Connection point.
⇒ Flexibility.
⇒ Easy maintenance.

Q19) Difference between Thermister & thermostat?

⇒

THERMISTOR	THERMOSTAT
⇒ Measures temperature changes.	⇒ Maintain a set temperature point.
⇒ Change ~~resistor~~ resistance based on temp changes.	⇒ Turn a circuit ON or OFF based on temp.
⇒ Provides a continuous analog output signal.	⇒ Provides a digital discrete output signal.
⇒ High accuracy & used for monitoring & control.	⇒ Less accuracy used for simple control.

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* SYNCHROSCOPE WORKING:-

⇒ Synchroscope is an electrical instrument used to measure phase angle / frequency between two alternator / generator.

⇒ On synchroscope, the incoming generator terminal is connected to the same bus bar terminal like {R-R, Y-Y}.

⇒ If synchroscope rotating fast it means the frequency difference between two alternator is high & if rotates slowly that means frequency is almost same of both generator.

⇒ If synchroscope rotating clockwise means incoming generator frequency is high & if rotates anti-clockwise it means bus bar frequency is high.

⇒ There are ~~two~~ three method of synchronizing ~~All~~ dark lamp method, ~~two bright & one dark~~ All Bright lamp method, ~~Rotating lamp method~~ Two bright one dark lamp method.

⇒ When pointer of synchroscope stop at 12 clock that means both generator frequency are same & hence synchronize.

* Difference between Induction & Synchronous Motor :-

SYNCHRONOUS MOTOR	INDUCTION MOTOR
⇒ Synchronous motor requires DC excitation to be supplied to the rotor winding.	⇒ Induction motor don't require DC excitation to supplied to the rotor winding.
⇒ Synchronous motor requires a starting mechanism in addition to the mode of operation that is in effect once they reach Synchronous speed.	⇒ Three phase induction can simply start by supplying power, but single phase motor requires additional starting circuit.
⇒ Synchronous motor requires rotor winding.	⇒ Induction motor constructed with conduction bar on rotor form together squirrel cage.
⇒ As load increases, speed remains constant at synchronous.	⇒ As load increases, speed will keep on decreasing.

* MEGGER WORKING & How to Check Insulation :-

⇒ First how insulation is damaged? When motor starts drawing excessive current so by relation $H \propto I^2$ so motor winding will starts heating & insulation will damage.

⇒ For healthy insulation, Resistance should always be '∞' by relation $R = \frac{V}{I}$ if no current flowing to the motor body the resistance will be '∞' & if any current is leaking then resistance will start decreasing.

⇒ How to check Insulation? With megger we can check insulation, the megger -ve ~~tr~~ probe always connect to motor body or any non-conducting body & +ve probe connect to motor terminal check the reading of megger before checking motor breaker should be shut.

⇒ Megger works on the principle of electromagnetic attraction. It has DC generator with handle & clutch arrangement, 2 coils voltage & current coil.

⇒ The voltage coil is connected across generator positive & negative terminal, whereas one end of current coil is connected to output of voltage coil & other end is free.

⇒ The current coil is placed in between ~~at~~ two magnets with a pointer is connected to it, another wire is connected to the just before voltage ~~input~~ coil & wire other end is free.

⇒ Any wire need to test insulation is connected across these two free ends when handle is rotated manually a 500 V of DC generated.

⇒ Megger voltage varies from 500 V to 2500 V & there are two types of Megger i.e. Electronic type & Manual type.

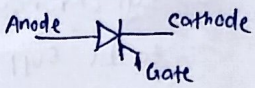
* ~~AVR WORKING? BRUSHLESS EXCITATION~~ :-

AMPLIFIER :-

A Amplifier is an electronic circuit that uses an external power to generate an output signal which is higher magnitude than it's input signal.

* THYRISTOR, TRANSDUCER, ZENER DIODE, THERMOCOUPLE :- PT100

⇒ A thyristor is a controlled rectifier where unidirectional current flow from anode to cathode is initiated by small signal current. from gate to cathode.



⇒ A transducer is like a sensor which transmit one form of energy to another like pressure or temperature transducer.

⇒ A diode is a device which allows the flow of current in forward bias & resistance to the flow of current in reverse bias but zener diode ~~not~~ allow in the forward as well as reverse bias to flow of current for the applied voltage.

⇒ Thermocouple is a device used to measure temperature of various machineries in engine room like Main engine, Auxiliary engine, Boiler, etc.

⇒ PT100 is a resistance temperature detector (RTD) type ~~device~~ sensor used to measure temperature like in refrigeration or HVAC system.

PT :- Platinum wire used.

100 :- Resistance value in Ω at 0°c.

* SCR, IGBT, SEMICONDUCTOR, DOPING

⇒ Silicon controlled rectifier also known as thyristor both has same function.

⇒ Insulated gate Bipolar transistor {IGBT} is a semiconductor device used to control & switch to high voltage & current. It is used in Electrical vehicle & Renewable energy systems.

⇒ Semiconductor are material which have a conductivity between conductor & insulators.

⇒ Doping are intentionally introduce impurities into an extremely pure semiconductor for the purpose of modulating it's electrical properties.

* BATTERY ROOM SAFETIES :-

⇒ Ventilation.

⇒ Fire detection & suppression.

⇒ Explosion proof equipment.

⇒ Access restrictions.

⇒ Personal protective equipment {PPE}

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* KIRCHOFF'S LAW :-

There are two types of Kirchoff law :-

⇒ Voltage law :-

The sum of potential or voltage drop taken around a circuit must be equal to the applied potential diffrence.

$$\boxed{\text{i.e } V_1 + V_2 + \ldots = -V}$$

⇒ Current law :-

The current flowing away from a junction point in a circuit must be equal to current flowing into that point.

$$\boxed{\text{i.e } I_1 + I_2 \ldots = -I}$$

NOTE:- What is Shunt ⇒ If we want to measure a current greater than the capacity of ammeter, shunt is used with ammeter in parallel connection.

* POWER FACTOR :-

The ratio between Active power & Apparent power is called power factor.

Power factor → $\cos\theta = \frac{\text{Active power}}{\text{Apparent power}}$

Active power ← in Kilo-watt (KW)

Apparent power ← in Kilo-volt-Ampere (KVA)

Power factor - Correction, Significance & it's value?

Significance :-

⇒ Power factor is an expression of energy efficiency expressed in percentage. A high power factor indicates that the power supplied to electrical system is effectively used & low power factor indicates the less efficient power usage.

Correction & Value :-

⇒ The correction means bringing the power factor near to one by using equipment which absorb or supply reactive power to the circuit. like Capacitor or Synchronous Condenser.

⇒ The correction will not change the amount of true power but it will reduce the apparent power and total current drawn from the load.

⇒ The most economical value of power factor lies between '0.9-0.95' but on my ship it was around '0.85'.

What happen if low power factor to equipment?

⇒ High power consumption.

⇒ Reduced efficiency.

⇒ Equipment can damage due to wear & tear.

What mean if power factor is high?

⇒ The higher the power factor, the more efficiently load uses the generator's energy.

How to maintain/monitor power factor of both parallel generator?

⇒ It's done through AVR {TELL THIS IF ASK BY NANDA}

⇒ By regulating excitation voltage in AVR, reactive power increase or decrease and desired pf is maintained.

⇒ If excitation voltage is increase then reactive power also increase and pf will reduce.

How to improve power factor? What is synchronous condenser & phase advancer?

⇒ Use of static capacitor :-

Static capacitor are connected in parallel with those devices which work or low power factor. These static capacitor provides leading current which neutralize lagging component of load current, thus power factor of load circuit is improved.

⇒ Synchronous Condenser :-

When synchronous motor operates at no-load & over-excited then it is called synchronous condenser. When synchronous motor is over-excited then it provide leading current & when it is connected in parallel then it draws leading current and partially eliminates reactive component so power factor is improved.

⇒ Phase advancer:-

Phase advancer is a simple AC exciter connected on the main shaft of motor & operates with the motor's rotor circuit. ~~As the stator winding of induction motor~~ for power factor improvement.

Difference between Leading & lagging pf?

LEADING POWER FACTOR	LAGGING POWER FACTOR
⇒ Leading power factor is used where the load current leads the supply voltage.	⇒ Lagging power factor is used where the load current lags behind the supply voltage.
⇒ Leading power factor signifies that the load current is capacitive.	⇒ Lagging power factor signifies that the current is inductive.
⇒ A leading power factor can be corrected by adding inductive loads.	⇒ A lagging power factor can be corrected by adding capacitive load.
⇒ The current phase angle is positive with respect to voltage phase angle.	⇒ The current phase angle is negative with respect to voltage phase angle.

* FARADAY'S LAW :-

⇒ According to faraday's law when a conductor is placed in a varying magnetic field, an emf is induced in conductor.

⇒ This magnetic field can be due permanent magnet and there should be relative motion between conductor w.r.to magnetic field or vice-versa in order to produce emf.

* CAPACITOR:-

Why capacitor is used in sealing fan & 1-phase motor? S.I unit of capacitance?

⇒ In order to store charge and provide initial starting current. Single phase motor are not self-starting to make self-start capacitor are used which provides high starting torque.

⇒ In ceiling fan also it's used to create a phase difference in the current of two winding which in turns creates a magnetic flux and rotate the rotor of fan.

⇒ The S.I unit of capacitance is 'farad' F.

* OVERLOAD :-

How to test overload trip?

⇒ By current injection method. Current is applied via external source to the relay to trip at set value.

What are the checks after overload trip?

⇒ Check the starter unit.

⇒ Check the overload relay and fuses.

⇒ Check for single phasing.

⇒ Check the load connected to the motor.

Overload trip :- principle, relay & circuit breaker working?

⇒

* EARTH FAULT :-

⇒ Earth fault is a fault between live conductor & earth caused by due to a break in the insulation, allowing the conductor to touch the hull.

Significance of earth fault?

⇒ If an earth fault occurs on the insulated pole it would be equivalent to a short circuit fault across the load via ship hull.

⇒ The resulting large fault current will immediately blow the fuse in line conductor & the equipment will be isolated from the supply.

⇒ The large fault current can cause sparking & ultimate damage at fault location.

How to find / detect earth fault?

Earth fault lamp :-

⇒ If there is no earth fault then lamp will glow equally if the earth fault occurs on one line then the lamp connected to that line is dim / doesn't glow & other lamps glow brighter.

Earth resistance meter :-

⇒ This system connects a small DC voltage between earth and each of the lines of the system in turn if there is a path to the voltage source through an earth fault a current will flow from DC source.

⇒ A meter is included in the current path to measure the size of current flow. With this type of instrument earth fault can be limited upto 1 MA whereas in earth lamp system it is about 60 MA.

Indication of earth fault on switchboard? Reading of multimeter in case of earth fault?

⇒ Earth fault lamp indicates the earth fault in a line fitted on main switchboard.

⇒ In case of earth fault, multimeter will show 'zero' reading.

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What action to take during earth fault?

⇒ Check the trueness of alarm with test button when pressed reset the alarm and recheck the condition of earth fault.

⇒ If the ship is having Intgrated automation system (IAS), check the list of alarm which one has activated on the computer.

⇒ If IAS facility is not available, there is only one option of isolating each and every machinery of 440V and check whether the earth fault indication back to normal.

⇒ Isolation of all 440V machinery is not always possible, certain critical equipment like steering gear & lubricating oil pump cannot be isolated when ship is sailing.

⇒ However changeover can be done from running machinery to standby one and thus the earth fault can be found.

How to rectify 440V earth fault?

⇒ Isolate the faulty circuit, disconnect and inspect cables and connections.

⇒ Repair or replace damage cables, connections.

⇒ Verify ~~earth fault~~ Insulation resistance & perform earth fault testing to ensure the fault is cleared.

⇒ Re-energize the system and monitor for fault.

Insulated earth neutral system meaning & significance? use?

⇒ When the neutral of generator is completely insulated from ship hull it is called insulated neutral system.

⇒ Two earth fault in two different line will cause a earth fault current to flow. So if single earth fault occurs it will not cut any protection equipment so machine will keep on working.

⇒ On ship insulated earth neutral system prefers as equipment will keep working if single earth fault occurs and raise a warning on earth's detection system.

⇒ The advantage of insulated earth neutral system is it maintains the continuity of electrical equipment like steering gear, M/E lube oil pump in case of earth fault & single earth fault does not cause a short circuit.

⇒ Insulated neutral system used in motor which run on 440 or 220 V like lube oil pump motor, steering gear motor, etc. since if one of the phase get short to motor body, it will not trip and keep running.

Difference between Insulated neutral & Earth neutral system?

EARTH NEUTRAL SYSTEM	INSULATED NEUTRAL SYSTEM
⇒ Used for HV system {Above 1000 V}	⇒ Used for LV system {upto 1000 V}
⇒ It will trip with 1 earth fault.	⇒ It will not trip with 1 earth fault.
⇒ Essential services are affected with 1 earth fault.	⇒ Essential services are continued even after 1 earth fault.
⇒ Here neutral is connected to earth by a neutral earth resistor.	⇒ Here neutral is not connected to earth.
⇒ Fault finding is easy as quick isolation is possible.	⇒ Fault finding is difficult.

Difference in Earthing system on ship & land?

⇒ At shore, neutral is connected to earth but on ship neutral is insulated & not connected to hull.

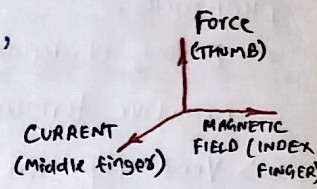
* LORENTZ LAW :-

⇒ A current carrying conductor placed in a magnetic field experience a force.

⇒ This force is Lorentz force & magnitude of this force is given by,

$$\boxed{F_L = i \times (l \times B)}$$

current — length of conductor — magnetic field.



⇒ The direction of Lorentz force (F_L) can be determined by flemings left hand rule.

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* BATTERY :-

Lead acid battery working?

⇒ Each cell of lead acid battery contains two sets of plates, immersed in electrolyte. The plate which connected to positive terminal of charged cell are of lead peroxide & the plate which connected to negative terminal are of lead.

⇒ The electrolyte in which plates are immersed is a dilute solution of sulphuric acid in distilled water.

⇒ During discharge, the hydrogen ions (H^+) removes oxygen from the lead peroxide (PbO_2) positive plates and combine with it to form water (H_2O). Loss of oxygen reduces it to grey lead (Pb).

⇒ The water formed by the action dilutes the electrolyte and the specific gravity decreases. At the negative plate of cell, sulphate ions (SO_4^{--}) combines with the pure lead of -ve plate to form a layer of white lead sulphate.

⇒ During the end of charging & discharging, the current flowing into the cell causes a breakdown of water in the electrolyte shown by bubbles at the surface. Both hydrogen & oxygen are released through vent caps into battery compartment.

Electrolyte used in lead acid battery?

⇒ Sulphuric acid (H_2SO_4) is used as electrolyte.

Charging & Discharging voltage of lead acid battery?

⇒ Charging → voltage = ~~1.95~~ 2.2 V, Specific gravity = 1.28.

⇒ Discharging → voltage = ~~1.8~~ 1.75 V, Specific gravity = 1.12.

Checks in Lead acid battery?

⇒ Connection to be checked for tightness.

⇒ Specific gravity to be check with hydrometer.

⇒ Check & clear vents to ensure H_2 gas produced is vented.

⇒ Check the level of electrolyte if fall below plate level then top up with distilled water.

⇒ Casing surface to be kept clean.

NOTE :- Nickel-cadmium is a type of alkaline battery.

Nickel cadmium (Ni-cd) battery working? Speciality of Ni-cd battery? Electrolyte used?

⇒ During discharging, Nickel hydrate {Ni(OH)} is converted to nickel hydroxide $Ni(OH)_2$.

⇒ Similarly hydroxyl ions (OH^-) converts cadmium to cadmium hydroxide of -ve plate.

⇒ OH^- moves from one plate to another doesn't affect the electrolyte so no generation of water like in lithium ion batteries so the specific gravity of electrolyte remains same.

CHARGING :-

⇒ During charging, the positive cell is connected to positive terminal & negative cell to negative terminal. Flow of current reverses the discharge action from the charging source

⇒ Vent caps are non-return valves because gases can be released but contact by electrolyte with atmosphere is prevented.

⇒ Electrolyte absorbs CO_2 from the atmosphere & damages the battery because of formation of potassium carbonate. So vent caps must be kept close.

Speciality of Ni-cd battery is it's specific gravity of electrolyte solution doesn't changes (1.210) as there is no generation of water.

Electrolyte used in this battery is potassium hydroxide.

Safetics in Battery room?

⇒ Intrinsically safe intrument & tools should be used inside.

⇒ Flameproof light must be used.

⇒ Metal jug should not be used as distilled water containers.

⇒ Ventilation duct should be above accomodation level and aft of engine room blower.

⇒ Battery should be placed on wooden block.

⇒ Acid-resistant paint should be used inside battery room.

Checks in Battery room?

⇒ Battery installation and it's charging rectifier checked.

⇒ Battery room environment must be dry and well maintained.

⇒ Charging equipment checked for dirt, overheating, loose connection and correct functioning of indicators.

⇒ Ventilation arrangement for battery locker checked.

⇒ Electrolyte at proper level and shall have correct value of specific gravity by checking with a hydrometer.

Types of Battery used on ship & it's capacity?

⇒ Lead acid battery & it's capacity is usually around 20 hour-rates.

⇒ Alkaline battery

Battery Charging Method?

Constant current Method :-

⇒ The charging current is kept constant by regulating the external resistance, the method being appropriated only for initial charging of the battery.

Constant voltage Method :-

⇒ The charging voltage is maintained constant. The charging current is high at the start however slowly reduce as the battery voltage builds up.

What is trickle charging?

⇒ Batteries gets discharged if not used due to local action. So once the battery is fully charged, it is put on trickle charge.

⇒ A very small amount of current is supplied to just make up for the loss of charge {Generally 50 to 100 MA per 100 Amp-hr battery capacity}.

How to check condition of battery?

⇒ Check state of battery reaching a hydrometer, specific gravity for alkaline battery does not change much during charging or discharging.

⇒ Ensure cells are covered with electrolyte if not top up with distilled water.

⇒ Check the battery terminal should be smeared with petroleum Jelly.

Battery specific gravity is less what to do?

Battery is charge still specific gravity is low what to do?

⇒ Clean surface of plates.

⇒ Under charged battery.

⇒ Top up with more electrolyte

Difference between Lead acid battery and Alkaline battery?

LEAD ACID BATTERY	ALKALINE BATTERY
⇒ Concentrated sulphuric acid is used as electrolyte.	⇒ Electrolyte used as potassium hydroxide.
⇒ positive plate is lead oxide & negative plate is lead.	⇒ Positive plate is manganese oxide & negative plate is zinc metal.
⇒ Electrolyte consumed during discharging.	⇒ Remains unchanged because equal amount of hydroxide ions consume & form during discharging.
⇒ Can be rechargeable.	⇒ Not rechargeable.
⇒ Chemical energy stored in the electrolyte.	⇒ Chemical energy stored in the zinc metal.

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Battery load test? How to test battery voltage?

⇒ With an approved load tester, check terminal voltage before connecting load tester and after load testing also check the terminal voltage it should not drop more than 12% of rated voltage.

⇒ Switch off the main and emergency supply to equipment also to the battery charger circuit note the voltage at battery terminal before switching off.

⇒ Calculate the deliver current by means of voltage and power & divide it by total AH that battery will deliver. So that will get discharge time.

⇒ Keep monitoring for that period of time, also note the value of voltage & ampere periodically.

The battery voltage is tested by multimeter, the total voltage should be between 12.4-12.7 V when not on load & not less than 12.2 V when under load.

How to know weak cell in battery? How many cell in 12V battery?

⇒ By doing load test, when the cell minimum voltage is reached pre-maturely that means cell need to replaced.

⇒ Other sign of weak cell is slow cranking during starting, Dimming light, frequent jump starts.

⇒ In 12V battery, total 6 cells are there each cell of 2V.

Where you connect 12V battery if AVR fails?

⇒ If AVR fails, connect 12V battery to stationary excitor field by observing polarity.

How battery will start emergency generator?

⇒ The battery provides power supply to the DC motor which cranks the engine for starting

Emergency battery regulations?

⇒ The emergency battery shall be capable of carrying load without recharging & battery voltage throughout the discharge period must be maintained within 12% above or below it's nominal voltage.

⇒ The battery is automatically connected to loss of main power and are required for power source for 30 min for following items :-

⇒ Fire detecting and fire alarm.

⇒ Navigational light.

⇒ Emergency lighting.

⇒ Internal communication equipment.

⇒ Emergency battery shall not be located in the same ~~place~~ space as the emergency switchboard.

Emergency battery checks? Routines? Inspection? Maintenance?

CHECKS :-

⇒ Check for bulging and deformation. Examine the outside appearance of battery.

⇒ Check the container for cracks this can lead to external short-circuiting.

⇒ Check the top of the battery, connections should be clean, free of dirt, corrosion and apply petroleum jelly on the terminal to prevent corrosion. Ensure vents are clear.

⇒ Check the specific gravity, voltage, negative terminal temperature for each individual cell and ambient temperature around the batteries and record.

⇒ Check the batteries are secured properly on wood & check the electrolyte level of batteries do not top up when battery is not charged. Final topping to be carried out when in a fully charged condition.

MAINTENANCE :-

⇒ Connection to be checked for tightness.

⇒ Terminal are protected with petroleum jelly or vaseline.

⇒ Batteries to be topped up with distilled water.

⇒ Check & Clear vents to ensure H_2 gas produced is vented.

⇒ Specific gravity to be checked with hydrometer during charged and discharged condition.

ROUTINES :-

⇒ Every week cell voltage is checked.

⇒ The Specific gravity is monitored using the battery hydrometer.

⇒ The terminals are lubricated to prevent corrosion.

⇒ Load test are done sometimes.

* EMERGENCY GENERATOR :-

SOLAS regulation of emergency generator? Location of Emergency generator?

⇒ Flash point of fuel should not be less than 43°C and should be capable of giving power upto the period of 18 hrs for cargo ship & 36 hrs for passenger ship.

⇒ It should have atleast two independent source of starting both of them should be provided atleast 3 consecutive starts.

⇒ It shall be started at 0°C or shall have separate heating arrangement and should be able to start in 22.5° list & 10° trim.

⇒ Should be started automatically after failure of main source of power supply within 45 seconds and it's rated load.

⇒ It should be located above waterline, should not located forward of the collision bulkhead. The compartment should be accessible from open deck and located outside from the engine room.

Emergency generator Testing?

⇒ The testing of emergency generator is done every week by running it unloaded to check it starts on battery mode. The hydraulic start is done every month to ensure that it is working fine.

⇒ Also every month automatic start of generator also done to see whether it comes on load. The testing of emergency generator on full load can be done without black out usually at anchorage / port where no cargo operations are in process.

⇒ After doing pre-checks, activate the breaker in the ECR connecting the ECR MSB & ESB, the emergency generator will start within 45 seconds.

⇒ Then start the equipment which get supply from the ESB. It will attain full operating load & for stopping the generator, the breaker is closed again due to the interlock the generator comes on off load.

Method of starting of Emergency generator?

PROCEDURE FOR BATTERY START :-

⇒ On the panel of emergency generator, put the switch on the test mode from the automatic mode. The generator will start automatically but will not come on load.

⇒ Check voltage & frequency on the panel, check the sump level & exhaust temperature.

⇒ To stop the generator, put the switch in manual, then stop the generator.

PROCEDURE FOR HYDRAULIC START:-

⇒ Put the switch in manual mode, check pressure gauge for sufficient oil pressure.

⇒ Open the valve from accumulator to generator & push the spring loaded valve and generator will start.

⇒ Check all the parameters as stated above and for stopping operate manual stop button from the panel.

⇒ After stopping the generator, pressurize the hydraulic accumulator to desired pressure and close the valve from accumulator to generator.

Supplies from Emergency switch board?

⇒ Emergency fire pump.

⇒ 1 steering gear.

⇒ 1 E/R vent fan.

⇒ High pressure pump for local fire fighting.

⇒ High & low expansion foam liquid pump.

⇒ Emergency transformer.

⇒ Emergency light.

⇒ Navigation light.

⇒ Fire alarm & general alarm.

⇒ Emergency battery charging.

* SEMICONDUCTOR:-

What is Semiconductor? Types of Semiconductor?

⇒ Semiconductor are material which have conductivity between conductor & insulator.

⇒ Semiconductor material have more number of free electron than insulator but less than conductor. Semiconductor can be pure element, such as silicon or germanium.

⇒ Conductivity of semiconductor increase with increase in temperature & it's conductivity is increased by Doping.

TYPES OF SEMICONDUCTOR

- Intensive pure Semiconductor
  - No. of electrons = No. of holes
- Extensive impure Semiconductor
  - P-type
    - Obtained when trivalent impurities are added to pure germanium crystal. Also known as acceptor.
  - N-type
    - Obtained when pentavalent impurities are added to pure semiconductor. Also known as donor.

What is Doping & it's material?

⇒ Doping intentionally introduce impurities into an extremely pure semiconductor for the purpose of modulating it's electrical properties.

⇒ The impurities are dependent upon the type of semiconductor. Lightly and moderate doped Semiconductor are referred to as extrinsic.

⇒ Material :- Aluminum, Boron, Phosphorous, Arsenic.

* THERMISTOR :- {THERMAL + RESISTANCE}

Where thermistor used? Working? Types? Difference between Thermister & thermostat?

REFER PG NO {3-4}.

* DIODES :-

What is Diode? Types of Diode?

⇒ Diode is an electrical device which allow current to move in one direction only.

⇒ Basically diodes are used for the purpose of rectifying waveform and can be used within power supplies.

TYPES OF DIODE :-

⇒ Vacuum tube diode.

⇒ Zener diode.

⇒ Photo diode.

⇒ Light emitting diode (LED)

When the diode is switched ON or forward biased, the electron recombines with the holes & release energy in the form of ~~hole~~ light. The colour of light depends on the energy gap of semiconductor.

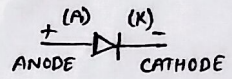

FIG :- DIODE

⇒ Avalanche diode.

The diode operates in reverse bias and used avalanche effect for it's operation.

The avalanche effect is a phenomenon when a reverse electric field is applied across p-N junction that leads to a large current. This avalanche effect allow large current in material.

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Use of Diode?

⇒ As rectifier, signal limiter.

⇒ Switches.

⇒ Voltage regulator.

⇒ Signal modulator.

⇒ Signal mixer.

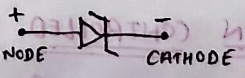

FIG :- ZENER DIODE

Zener diode principle?

⇒ Zener diode is a diode which allows current to flow in the forward direction as well as in reverse direction when the voltage is above certain value known as Breakdown voltage or Zener voltage.

⇒ It is always reverse connected when forward biased, zener diode do not burn out because it has entered breakdown ~~voltage~~ region as long as external supply connected to diode limit the fault current less than burn out value.

⇒ In zener diode, when it is reverse biased potential difference between two points does not cross a certain level. It is heavily doped.

* TRANSISTOR :- {TRANSFER + RESISTANCE}

What is transistor? Types of transistor?

⇒ Rectifier and zener diode are two layer semiconductor devices whereas transistor have 3 layer which are arranged as either NPN or PNP.

⇒ Transistor is a semiconductor device used to amplify and switch electronic signal and electronic power.

⇒ The operation is based on application of voltage will make -ve current carriers move in one direction and positive current carrier in other direction.

TYPES OF TRANSISTOR
- BIPOLAR JUNCTION TRANSISTOR (BJT)
  - n-p-n
  - p-n-p
- FIELD EFFECT TRANSISTOR (FET)

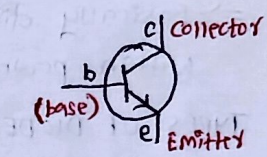

Fig :- n-p-n symbol

⇒ A transistor transfer the resistance from one end to other. A transistor has high resistance in the input section while low resistance in the output section.

* THYRISTOR :-

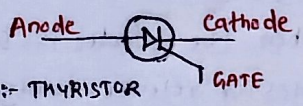

Fig :- THYRISTOR

Working of Thyristor?

⇒ A thyristor is a 4-layer device with alternating P-type & N-type semiconductor (P-N-P-N). The primary function of thyristor is to control electric power and current by acting as a switch.

⇒ Thyristor are solid state switches which are turned ON by application of low-level signal voltage through a trigger connection known as Gate electrode.

⇒ Thyristor remains functional in the long term without developing a fault and operate under right condition.

* SILICON CONTROLLED RECTIFIER {SCR} :-

Working of SCR? Use?

⇒ An SCR in circuit will resist current flow in working direction, apart from leakage since the middle junction is np or reverse biased.

⇒ Leakage is somewhat greater than with a simple diode because the pn junction on either side are sources of extra minority carriers when forward biased.

⇒ If applied voltage is increased, more minority carriers are emitted from the outer

junction and leakage increases more than in a diode.

⇒ During normal operation SCR is turned ON by gate signal much lower than the breakdown voltage. Working voltage would be anywhere between the range of breakdown voltage.

APPLICATION :-

⇒ Used in mainly D.C power supplies.

⇒ As a latching switch in an alarm circuit.

⇒ Used for conversion of A.C to D.C, but by varying the trigger turning part of the wave can be blocked.

⇒ Triac are two directional switches, designed for use in A.C application and able to switch to pass current in either direction.

NOTE :-

⇒ Diodes have two alternate layers of p-n.

⇒ Transistor have three layer.

⇒ Silicon controlled rectifier (SCR) have 4 layers.

⇒ TRIAC have more than 4 layers.

* MEGGER :-

Megger working? principle? Readings? Insulation test?

⇒ REFER PG NO {5}

When electric circuit being tested, the voltage coil will be maximum means no current flow through deflection coil and the pointer finds to '∞'.

If there is short circuit, pointer shows 'ZERO' which means no resistance allows high electric current to pass through the deflection coil.

* CLAMP METER :-

Construction & working of Clamp meter?

⇒ Clamp meter is an instrument used to measure the current flowing through a conductor. An AC clamp meter basically consist of current transformer (CT) in it's jaw. Utilizing the current transformer {CT} principle, reading will be displayed.

⇒ When the instrument is clamped on a conductor, the conductor itself act as primary & the magnetic flux due to current flowing through the conductor cuts the secondary of current transformer (CT).

⇒ The current in the secondary of the CT is converted to the voltage using a current to voltage converter. This signal is fed to analog to digital converter & the micro-controller employed will display the circuit for current reading.

* STATIC ELECTRICITY :-

What is Static Electricity?

⇒ Static electricity is an imbalance of electric charge within or the surface of material. The charge remains until it is able to move away by means of an electric current.

⇒ The static electric charge is created whenever two surface contact separate and at least one of the surface has high resistance to electric current.

⇒ Static electricity is generated by friction that occurs between different material during relative motion. Electrostatic charge can accumulate in material which are poor conductor of electricity.

⇒ It may occur in tankers because of an electrostatic charge is generated in the liquid as it flows turbulently through pipeline into ship tank.

* BONDING :-

What is Bonding?

⇒ The word bonding ~~means to joins~~ used for joining two wires, conductors or pipes together.

⇒ Bonding is known as connecting the metallic parts of different machines which is not considered to be carrying electric current during normal operation of machine to bring them at same level of electric potential.

* NEUTRAL :-

What is Earth, Neutral & Ground?

NEUTRAL :-

⇒ Neutral is return path for an AC circuit which is supposed to carry current in normal condition.

⇒ The magnitude of this current is in fraction of phase current & in few case it can be double of phase current.

⇒ So neutral wire is always assumed to be charged. This neutral wire is earth to make the second terminal of neutral wire at zero potential.

EARTH :- {GROUND OR EARTH ARE SAME}

⇒ Earth is for safety concerns against leakage or residual currents via least resistance path.

⇒ While neutral is connected to the main power wiring, earth is connected to equipment body which in normal condition does'nt carry current but in case of ~~int~~ insulation failure, it's suppose to carry minor current.

⇒ The current is usually much lesser than line current in 'mA'. But this current is good enough to kill someone or may risk fire & such current sent to earth via earth wire.

Difference between Earth & Neutral?

EARTH	NEUTRAL
⇒ It is least resistance path & used for safety purpose against residual current.	⇒ In AC circuit, which carries current in normal conditions, it is return path that balances the load.
⇒ In normal conditions, it doesn't carry any current but in case of insulation failure it might carry minor current.	⇒ A neutral wire is always charged.
⇒ It cannot be turned into neutral.	⇒ It can be turned into earth.
⇒ It can come from a neutral line or can be separately executed.	⇒ It comes from a neutral line.
⇒ Earthing is the surging point of appliances.	⇒ Neutral is the return path of electrical current supply also called as reference point

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* ALTERNATOR :-

Why Star Connection in Alternator?

⇒ In star connection, phase voltage is $\boxed{V_{phase} = \sqrt{3}\, V_{line}}$. Since the induced emf in the phase winding of the alternator is directly proportional to the number of turns.

⇒ A star connected alternator will require lesser number of turn than a delta connected ~~con~~ alternator for the same line voltage, hence copper is also save.

⇒ It is because third harmonics can be eliminated using star connected and distributed windings in 3-phase alternator.

What are the maintenance of Alternator?

⇒ Clean air filter.

⇒ Check condition of winding.

⇒ Remove dust from rotor.

⇒ Check insulation resistance with megger.

⇒ Check air gap with the plastic feeler gauge. {Metal feeler gauge can damage winding insulation}

⇒ Check lube oil level in bearing.

⇒ Carry out continuity test.

What are the Alternator safeties? Alternator trips?

⇒ Under voltage / over voltage relay.

⇒ Under frequency / over frequency relay.

⇒ Over current relay.

⇒ Reverse power relay.

⇒ Earth leakage relay.

ALTERNATOR TRIPS :-

⇒ Under voltage trip.

⇒ Over current trip

⇒ Reverse power trip

If pole change what will happen in Alternator?

⇒ Change in output voltage.
⇒ Change in output frequency.
⇒ Unbalance output.
⇒ Reduce in power output.
⇒ Pole change can occur due to short circuit, overloading & maintenance errors.

What is flashing of Alternator?

⇒ Flashing is required when the residual magnetism left over with the excitor field. If the generator not used for long time or during major repair/maintenance of alternator results in loss of magnetism.
⇒ For magnetising field poles by giving external DC (12V) battery to stationary excitor field by observing polarity for about 10 minutes.

Why air gap is there in Alternator? What will happen if more or if less?

⇒ To avoid the mechanical contact between stator and rotor and to determine the condition of bearing.
⇒ If the air gap is more then decrease output voltage, abnormal vibrations, bearing wear and if air gap is less then noise increases, power factor increases, rotor can strike the stator and increased core losses.
⇒ Usually the air gap between stator and rotor is '2-3 mm'.

How to take standby alternator on load?

AUTO MODE:-

⇒ Turn the mode selection switch at main switch board synchronization panel to auto position & turn the ACB control switch to the close position.
⇒ The ACB closes and the load shared with other running generator.

MANUAL MODE:-

⇒ Turn the mode selection switch at main switch board synchronization panel to manual position & turn the synchroscope switch to the incoming generator position (G1, G2, G3).
⇒ The LED indicator ring on the synchroscope will begin to rotate.
⇒ Adjust the governor control switch (raise/lower) untill the synchroscope is moving slowly in clockwise direction as the synchroscope approaches 12'o clock position turn the ACB control switch to close position.
⇒ The ACB will close and close indication will be 'ON' then turn the synchroscope switch to OFF position.

Why alternator rating are given in KVA?

⇒ Alternator are rated in KVA because it measures the apparent power which is the total amount of power in use in system. The alternator conductor are calculated for definite current & definite voltage independent of power factor of the load

Alternator is which type of motor?

⇒ An alternator is a synchronous motor that uses rotating magnetic field & stationary armature to convert mechanical energy into AC.

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How to do paralleling without synchroscope?

⇒ Lamp dark method (2 lamps).

⇒ Lamp bright method (2 lamps).

⇒ Sequence method (3 lamps).

Why Alternator not developing any voltage OR not coming on load?

⇒ Loss of excitation.

⇒ Loss of residual magnetism.

⇒ Faulty AVR.

⇒ Failure of diodes.

⇒ Malfunction of slip rings & brushes.

What is overcurrent setting of Alternator?

⇒ The current setting of over current relay is '125%' of full load current.

Why undervoltage on Alternator occurs?

⇒ undervoltage can occur when the voltage drops below a certain level to prevent this undervoltage relay fitted ~~to~~ to circuit ~~breakes~~ breakers.

⇒ This relay prevents the closure of circuit breaker of dead generator or when voltage dip to around '50%'.

What is weekly routine of Alternator?

⇒ Replace air filter.

⇒ Check lube oil level in pedestal bearing.

⇒ Check condition of winding.

⇒ Remove dust from rotor.

⇒ Check sign of overheating, damage or wear.

How power factor of two alternator running in parallel are maintain equal?

⇒ Through AVR by regulating excitation current which is automatically maintained and adjust based on load conditions.

Working of AVR?

⇒ AVR is connected with generator output voltage and it has voltage sensing unit, comparator, amplifier & thyristor.

⇒ The voltage sensor senses the generator output voltage and produces a low voltage output proportional to generator output this low voltage output compared to a set value representing normal terminal voltage in the comparator.

⇒ Any deviation will generate error signal which will be amplified in the amplifier and further supplies to thyristor which supplies or control the excitation field.

~~Working of Brushless alternator?~~

* MOTOR :-

If motor is running on low voltage what safety is there?

⇒ Undervoltage protection relay.

⇒ Low voltage protection device.

What are the types of single phase motor? Where single phase motor used?

TYPES :-

⇒ Split phase.

⇒ Capacitor type.

⇒ Shreaded pol.

Application :-

⇒ Power tools.
⇒ Refrigerator.
⇒ Vacuum cleaners

} Equipment which runs on 220 V & 60 Hz.

What are the safeties in steering gear motor? Type of motor in steering gear?

SAFETIES :-

⇒ 200 % motor insulation.

⇒ Overload alarm.

⇒ Power failure alarm.

⇒ Phase failure alarm.

⇒ Motor should able to carry 200 % of full load current.

3-phase squirrel case induction motor is used in steering gear.

~~Synchronous motor~~

What are the reason for motor not starting {Electrical / Mechanical} both reason?

ELECTRICAL :-

⇒ Fuse melt or blown off.

⇒ Circuit breaker trip.

⇒ Single phasing

⇒ Single phasing.

⇒ Check supply from MSB.

NOTE :-

E/R crane → 3ϕ Induction motor

Turning gear motor → Double cage induction motor

MECHANICAL :-

⇒ Coupling is not alligned.

⇒ Bearing damage.

⇒ Shaft bend.

Types of Induction motor? What type of AC motor used onboard?

- A.C motor
  - Synchronous
  - Asynchronous {Induction motor}
    - Induction motor
      - Squirrel cage
        - Single cage
        - Double cage
      - Slip ring
      - wound ~~motor~~ rotor
    - Commutator motor
      - Series
      - Compensated
      - Shunt
      - Repulsion

What is Slip?

⇒ Slip is the difference between the speed of magnetic field & the rotor's speed. It is essential to produce torque & measured as percentage of Synchronous speed and value is less than 1.

What is Synchronous & Asynchronous motor?

⇒ The Synchronous motor is a type of AC motor that runs at synchronous speed & Slip is zero.

⇒ Asynchronous motor is a type of AC motor that runs at speed less than the Synchronous speed & there is slip in this motor which is always greater than zero.

How to check motor insulation resistance?

⇒ Switch on megger connect two probes together it should show zero {Megger test}.

⇒ Isolate motor breaker off, connect two probes to different earth point on motor should show zero {Earth test}.

⇒ Ensure that machine temperature is near to working temperature

What are the safeties in E/R crane motor?

⇒ Emergency stop.

⇒ Distance limit switches in both transverse & longitudinal direction.

⇒ Overload & Short circuit trip.

⇒ Automatic stopper for up-down to prevent the motor overloading.

⇒ Thermister trip for motor winding.

How to control speed of AC & DC motor?

DC MOTOR :-

⇒ Voltage control method.

⇒ Variable resistor method.
⇒ Armature control method.
⇒ Flux control method.

AC MOTOR :-

⇒ By changing applied voltage.
⇒ By changing applied frequency.
⇒ Change the number of stator pole.
⇒ Constant variable frequency control of Induction motor.

What are the types of motor starter?

⇒ Direct online Starter
⇒ Star delta starter.
⇒ Auto transformer starter.
⇒ Soft Starter.

What are the induction motor safeties?

⇒ Under voltage relay.
⇒ over current relay.
⇒ Single phasing protection relay.
⇒ Short circuit relay.

What are the causes of motor overheat? What to do in case of overheat?

⇒ Single phasing.
⇒ Bearing failure.
⇒ Motor running at overload.
⇒ Misalignment.
⇒ Defective cooling fan, blades.

ACTION :-

⇒ Check for single phasing after stopping the motor.
⇒ Check the fan in case it's broken.
⇒ Check the winding for sign of wear.
⇒ Check the bearing for damage.

What is Eddy current loss?

⇒ When an alternating magnetic field is applied to magnetic material since it's a conducting material emf in induced within it & circulate these currents are called eddy current
⇒ As these current responsible for doing any useful work and it produces a loss (I^2R) loss in the magnetic material known as eddy current loss.

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What will you do if motor immersed in sea water?

⇒ First stop & isolate the motor from supply then remove and take it to the workshop, dismantle and clean it by fresh water.

⇒ Then apply electro cleaner, then protective coating (varnish) has to be applied and heat in the oven by 70°c.

Where Induction motor & Synchronous motor used in engine room?

Induction motor:-

⇒ Steering gear motor.

⇒ Turning gear motor.

⇒ E/R crane motor.

Synchronous motor:-

⇒ Viscotherm.

⇒ Gyrocompass.

⇒ Radar motor.

⇒ Shaft generator.

⇒ Bow thruster.

* STARTERS:-

What are the types of starter?

⇒ Direct on line starter.

⇒ Star delta starter.

⇒ Auto transformer starter.

⇒ Soft starter.

Which starter used in turning gear motor & in Induction motor?

Turning gear motor:-

⇒ Reverse DOL starter is used.

Induction motor:-

⇒ Soft starter is used for bigger motor also star-delta used for medium size motor

* What is Back EMF?

⇒ When an EMF is generated by a change in magnetic flux, the polarity of induced emf opposes the change that produces a current is called Back emf.

⇒ OR in simple way, EMF is a voltage that opposes a supply voltage that powering a motor and is generated as the motor moves.

* What are the various classes of Insulation?

⇒ Class Y ⇒ 90°c.

⇒ Class A ⇒ 105°c.

⇒ Class E ⇒ 120°c.

⇒ Class B ⇒ 130°c

⇒ Class F ⇒ 155°c.

⇒ Class H ⇒ 180°c

⇒ Class C ⇒ 180°c

* What is single phasing ? Effects ? causes ?

=> Single phasing is a condition where one of the phases of three phase of AC motor is disrupted or disconnected resulting in loss of one phase of power.

EFFECTS :-

=> Loss of one phase cause increase in current flow in remaining two phases can lead to overheating & damage to motor winding.

=> Single phasing reduces motor torque can cause motor to slow down.

=> The unbalanced current flow & reduce torque can cause motor to overheat & lead to more noise & mechanical stress.

CAUSES :-

=> Blown fuse.

=> Loose connection.

=> Circuit wire is damaged & short circuited.

* HOW MAPS WORKS ?

=> MAPS works on the principle of electrolysis. It involves usage of Aluminium & Copper anodes, it is normally fixed in pairs in the sea chest in the direction of flow of water.

=> The system has control unit which supplies impressed current to anodes, the copper anodes produces ions which are carried by water to prevent marine growth.

=> Due to impressed current, aluminium anode produces ions which spread over system and produce anti corrosive film.

NOTE :- Aluminium & zinc are used as anode in MAPS & ICCP

* HOW ICCP WORKS ?

=> When two dissimilar metal are in contact with each other in presence of corrosive medium {Electrolyte}, the more active in the galvanic series act as an anode and undergoes corrosion.

=> ~~In ICCP, the metal to be protected is connected to protected anode and current is passed through a DC source.~~ Protective

=> Here a contact point taken on the ship hull and connected to reference electrode, this electrode measures the potential difference between the hull & refernce cell.

=> Thus the current passes from the control panel to protective anode to occur off the surface of anode into electrolyte and metal {cathode}.

=> The magnitude of this current may be automatically controlled in response to continue monitor of cathode / electrolyte potential.

* What is Ingress protection (IP) rating? Deck & sea water motor IP rating?

=> The IP code for electrical equipment consist of letter 'IP' followed by two digit.

⇒ The IP rating system classifies the degree of protection provided against the intrusion of foreign objects such as dust or water in electrical enclosures.

⇒ The aim of IP rating to provide detailed information such as :-

First number of IP code :- protection against dust or solid foreign object.

Second number of IP code :- protection against water.

IP for Deck motor :-

⇒ IP 56 is recommended against dust and water splashes.

IP for Sea water pump motor :-

⇒ IP 65 or higher is prefer, providing protection against water jets.

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* What is the synchroscope construction?

⇒ Synchoscope consist of small motor with coils on the two poles connected across two phases. of the incoming generator and armature winding supplied from ~~fed~~ two phases (R&Y for ex) of the switchboard bus bar.

⇒ The bus bar consist of inductance & resistance connected in parallel and fed into synchroscope with the help of slip rings to armature winding which produces rotating magnetic field.

⇒ The polarity of the poles will change in north/south direction with change in two phases of the incoming machine. The rotating field will react with the poles by turning the rotor in clockwise or anti-clockwise direction.

* How variable frequency drive (VFD) works?

⇒ A variable frequency drive is a semiconductor based motor starter. It can safely start & stop electric motor as well as control the speed of motor during it's operation.

⇒ Since the speed of induction motor depends on the supply frequency, VFD is mostly used for varying the speed of motor.

⇒ A VFD has three circuit i.e, DC filter, Rectifier & Inverter. First, the AC line voltage is converted into DC using rectifier circuit then smoothen by passing through the DC filter.

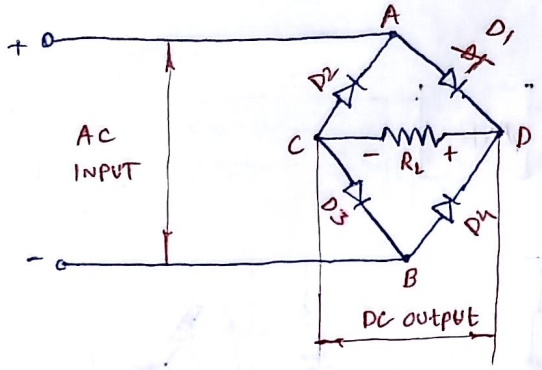
⇒ The steady DC voltage is then converted into AC using the inverter circuit. The inverter logic control circuit allows to vary the voltage as well as frequency of the output AC voltage.

X — X — X — X — X — X — X

End of this notes See you soon in Class 2 Stay connected.....

Sabish
23/02/25

R-24
Q1 b]



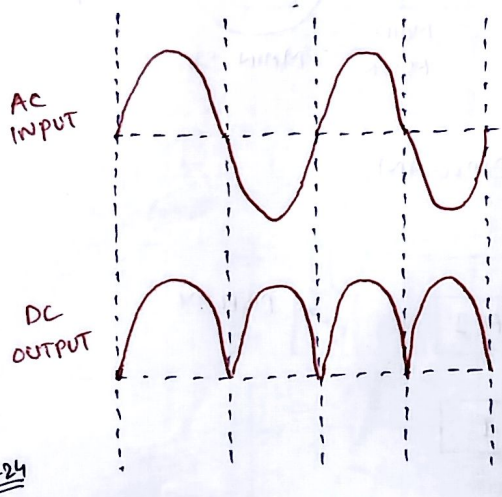


FIG 1.1 :- BRIDGE RECTIFIER

R2-24
Q2 b] i)

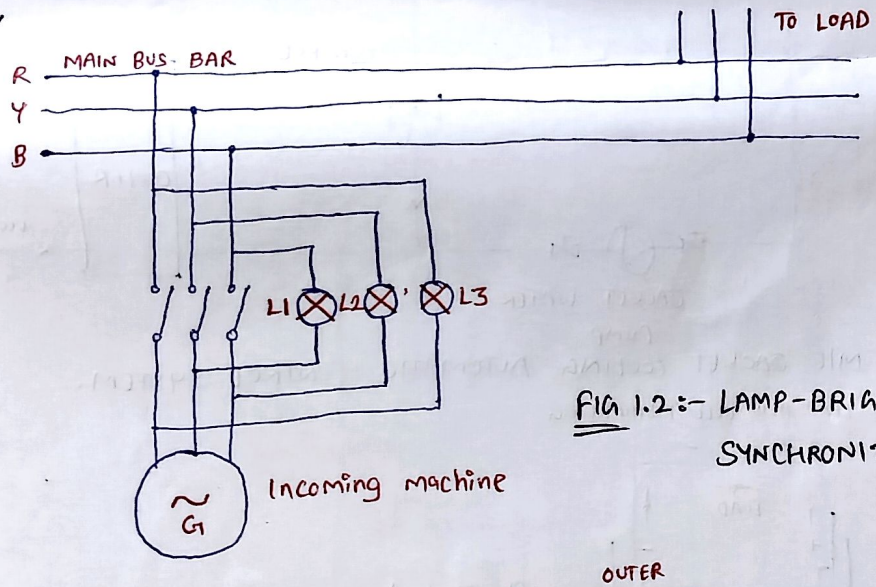


FIG 1.2 :- LAMP-BRIGHT CONFIGURATION FOR SYNCHRONIZING GENERATOR.

m-24
Q3 b]

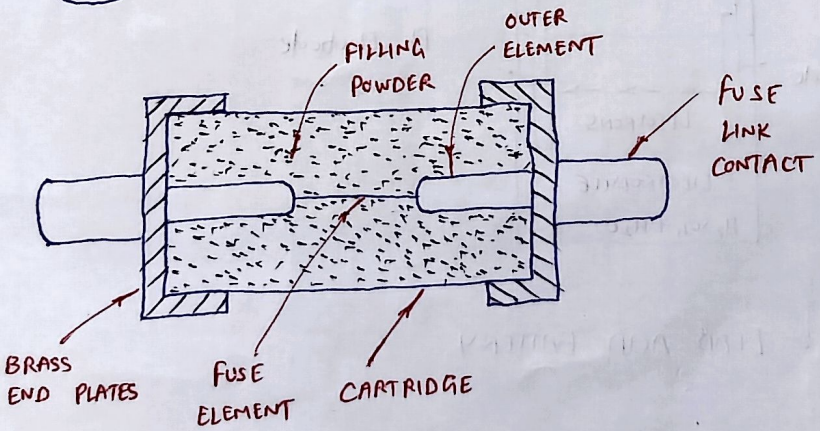


FIG 1.3 :- HIGH RUPTURE CAPACITY FUSES.

APR-2-24
Q5) b]

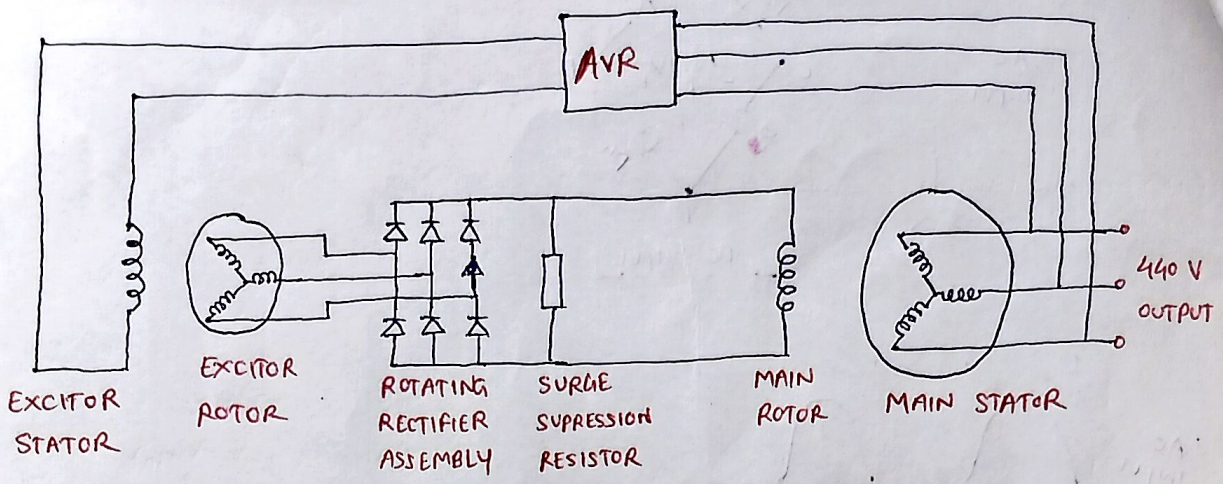


FIG 1.4 :- BRUSHLESS ALTERNATOR DIAGRAM.

Jan-24
~~Q3) b]~~
Q1)

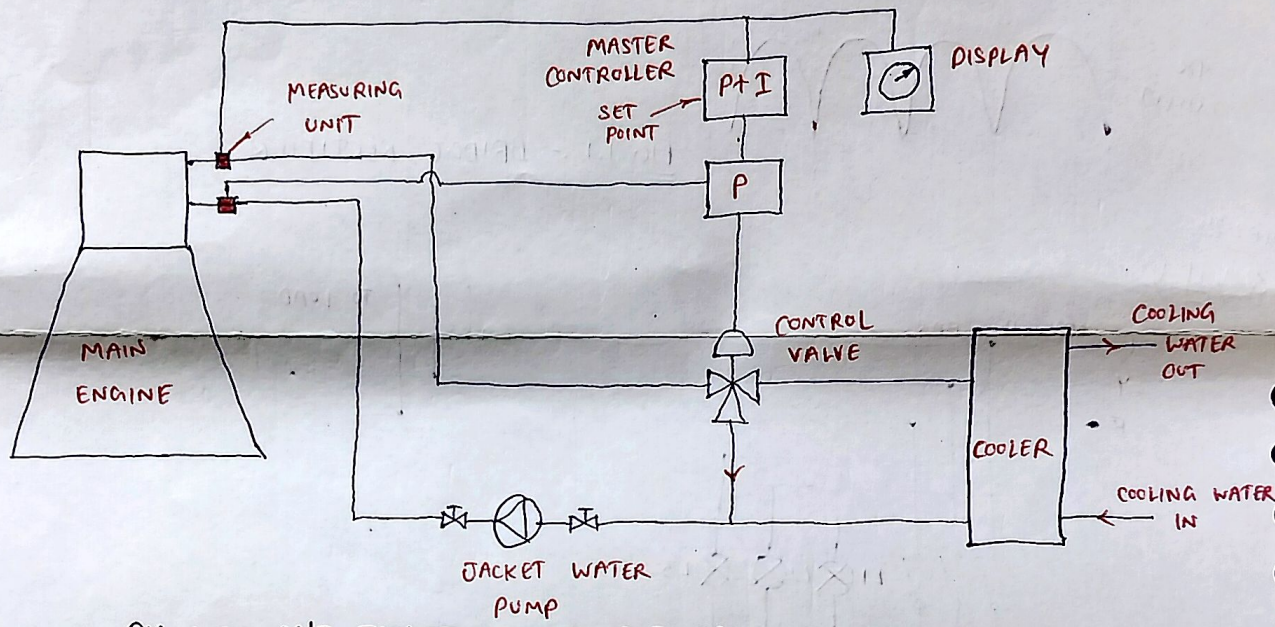


FIG 1.5 :- M/E JACKET COOLING AUTOMATIC CONTROL SYSTEM.

FEB-24
Q3) a]

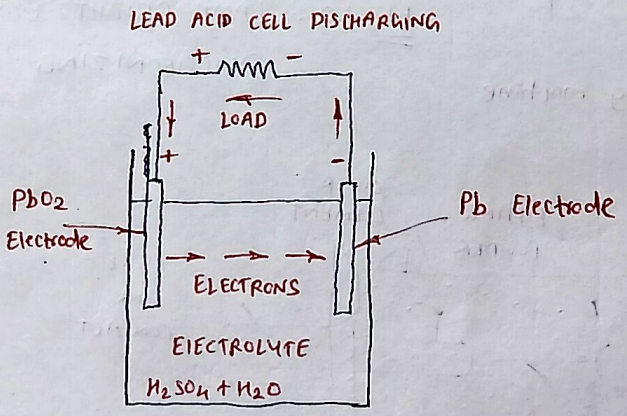


FIG 1.6 :- LEAD ACID BATTERY.

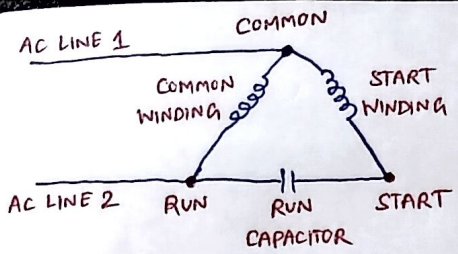


FIG 1.7 :- MOTOR TERMINAL CONNECTION.

FEB-24
Q4

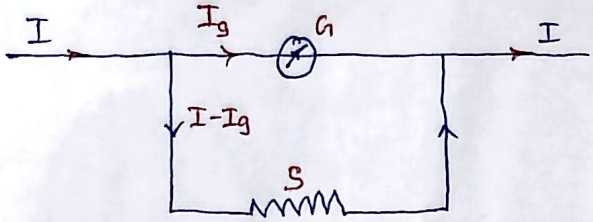


FIG 1.8 :- GALVANOMETER USED AS AMMETER.

FEB-24
Q5

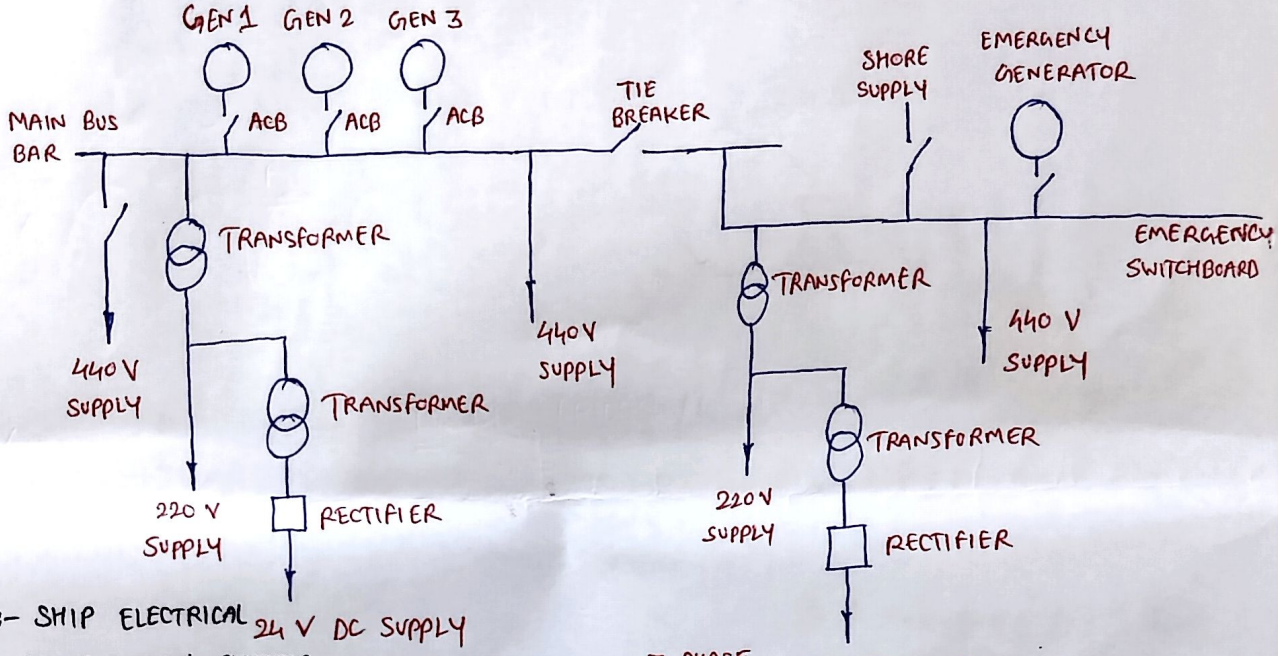


FIG 1.9 :- SHIP ELECTRICAL DISTRIBUTION SYSTEM.

FEB-24
Q1 B

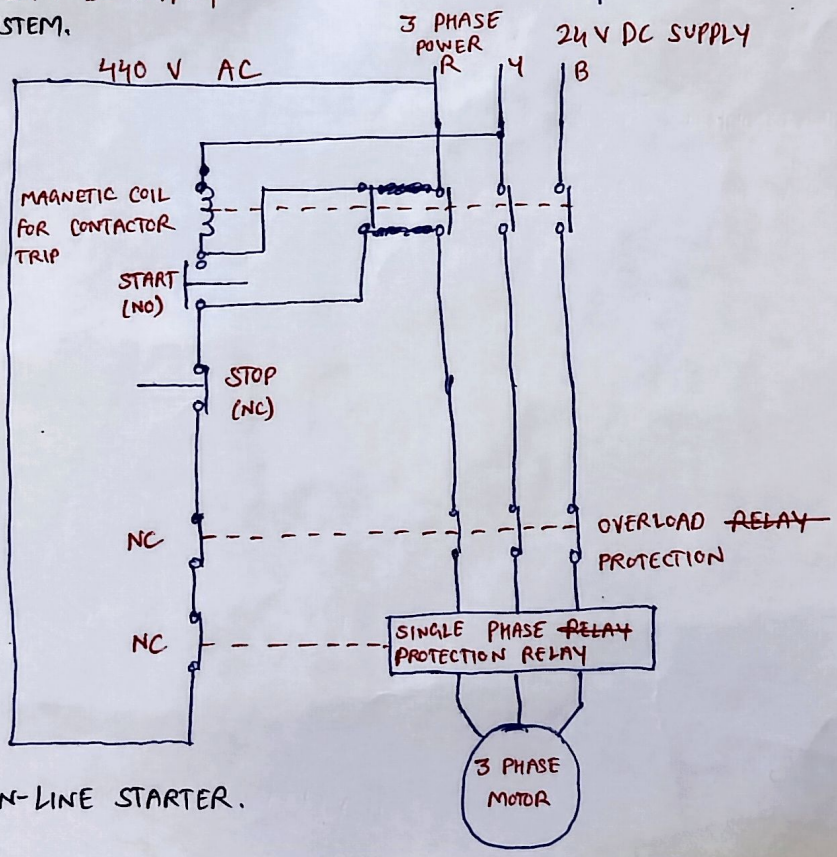


FIG 1.10 :- DIRECT ON-LINE STARTER.

* **IMPORTANT POINTS :-**

⇒ Synchronous Condenser :- When a synchronous motor operates at No-load & over-excited then it is called synchronous condenser.

⇒ MSB safetics mention in 'SOLAS Chapter 2-1, part D regulation 45 & 41'.