Roll No.										

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST 1

Sem & AY: Odd Sem 2019-20 | Date: 30.09.2019

Course Code: EEE 101 | Time: 9.30AM to 10.30AM

Course Name: ELEMENTS OF ELECTRICAL ENGINEERING | Max. Marks: 30

Program & Sem: B.Tech (Physics Cycle) & I | Weightage: 15%

Instructions:

(i) Read the question properly and answer accordingly.

(ii) Question paper consists of 3 parts.

(iii) Scientific and Non-programmable calculators are permitted.

Part A (Memory Recall Question)

Answer all the Questions. Each Question carries four marks. (3Qx4M=12M)

1. Define (i) Real Power (ii) Reactive Power, and (iii) Apparent Power as applied to single phase AC circuits. (C.O.NO.1) [Knowledge]

2. Show that the equivalent resistance of two resistors connected in parallel is the ratio of the product of those two resistances divided by the sum of those two resistance value. (C.O.NO.1) [Knowledge]

3. State Kirchhoff's laws. (C.O.NO.1) [Knowledge]

Part B (Thought Provoking Question)

Answer both the Questions. Each Question carries four marks. (2Qx4M=8M)

4. To a purely resistive load an AC sinusoidal signal is applied whose peak value is 10 volts and frequency is 50 Hz. A purely resistive load operates at unity power factor. A Digital multi-meter was used to measure the magnitude of AC current and the meter showed 3.53 A (R.M.S). Compute the active and reactive power consumed by the load.

(C.O.NO.2) [Comprehension]

5. The lamps in a set of Christmas tree lights are connected in series, if there are 20 lamps and each lamp has a resistance of 25 Ω, calculate the total resistance of the set of lamps, and hence calculate the current taken from a 230 V supply.
(C.O NO.2) [Comprehension]

Part C (Problem Solving Question)

Answer the Question. The Question carries ten marks. **(1Qx10M=10M)**

6. A circuit consists of a resistance of 20 Ω, an inductance of 0.05 H connected in series. A supply of 230 V (R.m.s) at 50 Hz is applied across the circuit.
   a) Identify the unknown quantities that could be found from the given data. [4M]
   (C.O.NO.2) [Comprehension]
   b) Compute the unknown quantities from the given set of data. [6M]
   (C.O.NO.1) [Comprehension]

SCHOOL OF ENGINEERING

Semester: ~~5th~~ 1st Sem

Course Code: EEE ~~2~~09

Course Name: Electrical and Electronic Measurement and Instrumentation

Date: 30.09.2019

Time: 9:30am to 10:30 am

Max Marks: 30

Weightage: 15%

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels			Thought provoking type [Marks allotted] Bloom's Levels			Problem Solving type [Marks allotted]			Total Marks
			K			C			A			
1	2	2		4								4
2	1	1	4									4
3	1	1	4									4
4	2	2						4				4
5	1	1				4						4
6	2	2								4	6	10
	Total Marks											30

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

[I hereby certify that All the questions are set as per the above guide lines. Mr. Bishak Paul]

Reviewers' Comments

Annexure- II: Format of Answer Scheme

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE REACH GREATER HEIGHTS

SOLUTION

Semester: 5th

Course Code: EEE 209

Course Name: Electrical and Electronic Measurement and Instrumentation

Date: 30.09.2019

Time: 9:30am to 10:30 am

Max Marks: 40

Weightage: 20%

Part A (3Q x 4M = 12Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	**Reactive power** represents electrical energy stored in the coil that then flows back to the grid. Ideal coils do not consume any electrical energy, but create a significant electric current. **Real power** is the power actually consumed due to the resistive load and **apparent power** is the power the grid must be able to withstand. The unit of real power is watt while apparent power unit is VA (Volt Ampere)	**1 mark for each definition**	5
2	$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \ldots\ldots + \frac{1}{R_n}$ etc	**4 marks for answering the question**	5
3	**Kirchhoff's Current Law (KCL):** This law is also called **Kirchhoff's junction rule** or **Kirchhoff's point rule.** It states that the algebraic sum of the currents meeting at a node or junction is equal to zero.(or) The	**2 marks for KCL and 2 marks for KVL**	5

sum of the currents entering at a node is equal to the sum of the currents leaving that node.

Kirchhoff's Voltage Law (KVL)

This law is also called Kirchhoff's loop rule. It is a consequence of the principle of Conservation of energy. It states that "The algebraic sum of the potential differences around a circuit must be zero".

Part B (2Q x 4M = 8 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
4	Active power= $V_{rms}I_{rms}\cos\emptyset$= 24.96 W Reactive power= $V_{rms}I_{rms}\sin\emptyset$= 0	4 marks for active power and 4 marks for reactive power	10
5	Total Resistance= 20×25=500 ohms Current= 230/500=0.46 A	4 marks for resistance and 4 marks for current	10

Part C (1Q x 15M =15 Marks)

Q No	**Solution**	**Scheme of Marking**	**Max. Time required for each Question**
6	Peak Current, R.m.s current, impedance, inductive reactance, power factor angle, power factor, active power, reactive power X_L=15.7 Ω Z= 25.4 Ω I(peak)= 13 A I(rms)= 9.2 A Ø=38.13 cosØ= 0.78 active power= 1650 W Reactive power= 1306 VAr	4 marks for Identifying the unknown quantities and 6 marks for computation	20

Roll No.													

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST – 2

Sem & AY: Odd Sem 2019-20
Course Code: EEE 101
Course Name: ELEMENTS OF ELECTRICAL ENGINEERING
Program & Sem: B.Tech & I Sem

Date: 18.11.2019
Time: 9.30 AM to 10.30 AM
Max Marks: 30
Weightage: 15%

Instructions:

(i) Read the questions properly and answer accordingly.
(ii) Question paper consists of three parts.
(iii) Scientific and Non-Programmable calculators are allowed.

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries five marks. (2Qx5M=10M)

1. Choose the correct answer. (C.O.NO.3)[Knowledge]
   (i) The number of parallel paths in wave connected winding of a D.C. Machine
   a) Equal to number of poles b) P/2 c) 2 d) 4
   (ii) The armature winding of D.C. generator is made of
   a) Iron laminations b) Solid Iron c) Copper d) Steel alloys
   (iii) It is required to convert mechanical energy to electrical Energy. Select the appropriate machine for the purpose
   a) Generator b) I.C. Engine c) Motor d) Transformer
   (iv) The armature power developed by a DC Motor is given by ____ watts.
   a) $V_L I_L$ b) $E_b I_a$ c) $I_a^2 R_a$ d) all of the above
   (v) Fleming's Left hand rule is applicable to
   a) Generator b) Motor c) Transformer d) none of these
2. Summarize the applications of D.C. Shunt Motor and D.C Series Motor. (C.O.NO.3)[Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries five marks. (2Qx5M=10M)

3. Why is the generated EMF in the DC motor termed as Back EMF? Discuss its significance? (C.O.NO 3)[Knowledge]
4. Give the constructional details of DC Generator and briefly explain the functions of any three parts. (C.O.NO 3) [Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each question carries five marks. (2Qx5M=10M)

5. An 4-pole DC generator has 800 armature conductor and a flux per pole of 0.03 wb and runs at a speed of 1500 rpm. Calculate the generated EMF if the armature is (i) Lap wound and (ii) Wave Wound. (C.O.NO 3)[Application]
6. A D.C Motor has 6 poles, flux per pole of 0.04 Wb with lap wound armature of 800 conductors. Motor speed is 600 rpm. Compute Back EMF and estimate the torque developed by the Motor in N-m. Given armature current is 30 amps. (C.O.NO 3)[Application]

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

Semester: 1

Course Code: EEE 101

Course Name: Elements of Electrical Engineering

Date: 18/11/19

Time: 9.30 am to 10.30 am

Max Marks: 30

Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	A	
1	3	Module 2 – introduction to D.C Machines	10			10
2	3	"		5		5
3	3	"	5			5
4	3	"			5	5
5	3	"			5	5
	Total Marks		15	5	10	30

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students

must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

Annexure- II: Answer Scheme

SCHOOL OF- ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SOLUTION

Semester: 1

Course Code: EEE 101

Course Name: Elements of Electrical Engineering

Date: 18/11/19

Time: 9.30 am to 10.30 am

Max Marks: 30

Weightage: 20%

Part A (10 Q x 1 M = 10 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1 a)	**(i) - c** **(ii) - c** **(iii)- a** **(iv) - b** **(v) - b**	5 M (One Mark each)	5 Min
b)	Applications of D.C. Shunt Motor, D.C Series Motor and D.C Compound Motors - 2 applications each	5 M	10 Min

Part B (2Q x 5M = 10Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
2	Significance of Back EMF in D.C. Motor	5 M	5 Min
3	Constructional details of DC Generator and explain in brief	Fig - 2 Marks Labeling - 1 M Explanation – 2 M	10 Min

Part C

(2Q x 5M = 10Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
4	Formula of Eg Eg = 600 Volts when Lap connected Eg = 1200 Volts when Wave connected	1 M 2 M 2 M	15 Min
5	Formula of T Eb = 320 V V = 330.5 T = 152.64 N-m	1 M 1 M 1 M 2 M	15 Min

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Semester: Odd Semester: 2019 - 2020 | **Date**: 30 December 2019

Course Code: EEE 101 | **Time**: 9:30 AM to 12:30 PM

Course Name: ELEMENTS OF ELECTRICAL ENGINEERING | **Max Marks**: 100

Program & Sem: B.Tech (Physics Cycle) & I | **Weightage**: 50%

Instructions:

(i) Read the all questions carefully and answer accordingly.

(ii) Draw the diagrams neatly and legibly

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries 2 marks. **(10Qx2M=20M)**

1. (a) Recall the concept of open circuit and short circuit. (C.O.No.1) [Knowledge]

   (b) Define average value and RMS value of an AC waveform with their expressions. (C.O.No.2) [Knowledge]

   (c) Recall the action of commutator in DC Generator (C.O.No.3) [Knowledge]

   (d) On which rule does the motor principle rely and define the same (C.O.No.3) [Knowledge]

   (e) Define the working principle of transformer and list the losses in a transformer (C.O.No.3) [Knowledge]

   (f) Define slip and give the mathematical expression (C.O.No.3) [Knowledge]

   (g) Recall any three difference between DC and AC Generator (C.O.No.3) [Knowledge]

   (h) Classify the measuring instruments (C.O.No.4) [Knowledge]

   (i) List any six of the Wiring accessories for house wiring (C.O.No.5) [Knowledge]

   (j) Brief the need of measurements and give the types of Electrical Installations (C.O.No.4, C.O.No.5) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each Question carries 12 marks. **(4Qx12M=48M)**

2. (a) Summarize the expressions of voltage drops, current and power when two passive elements such as resistors are connected in a series when operated from DC source voltage.

[CM] (C.O.No.1) [Comprehension]

3. (a) Briefly explain the concept of Counter EMF under diverse loaded Conditions with the equation corresponding to armature current. [6M] (C.O.No.3) [Comprehension]

(b) A DC Shunt motor has 6-poles, flux per pole is 0.05 wb with wound armature of having 60 conductors in 60 slots. The Armature of the motor rotates at a speed is 500 rpm. Compute the applied voltage and back EMF given when armature resistance is 0.25 ohm, armature current is 40 Amps. Also estimate the torque developed by the motor in N-m.

[6M] (C.O.No.3) [Comprehension]

4. (a) In a Synchronous generator, explain how can rotating field would be a beneficial aspect over stationary armature. [6M] (C.O.No.3) [Comprehension]

(b) A three phase 10 pole alternator has 90 slots, each containing 12 conductors if the speed is 600 RPM and flux per pole is 0.1 webers. Calculate the EMFs when the phases are Star and Delta connected.

[6M] (C.O.No.3) [Comprehension]

5. (a) Explain in detail the construction and working principle of the meter which is used for measuring the energy utilized by the electrical load

[6M (C.O.No.4) [Comprehension]

(b) Draw the operating table by assuming a lamp is connected in series with a single pole single through switch involving a protective device which is used for protecting the lamp.

[6M] (C.O.No.5) [Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each Question carries 16 marks. (2Qx16M=32M)

6. (a) A 100 kVA, 11kV/1400V, 50Hz single phase transformer has 110 turns of the secondary. Calculate the approximate values of the primary and secondary full load current, the maximum value of flux in the core and the number of primary turns.

[8M] (C.O.No.3) [Comprehension]

(b) A 4 pole three phase induction motor operates from a 50Hz supply. Calculate speed of the rotating flux, speed of the rotor when the slip is 0.05, rotor current frequency at a slip of 0.05 and the frequency of rotor current at standstill.

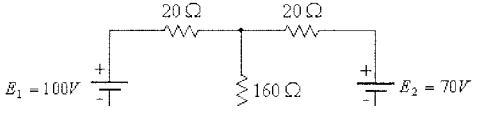
[8M] (C.O.No.3) [Comprehension]

7. (a) Describe virtual Instrumentation and explain various components of virtual instrumentation

[8M] (C.O.No.4) [Comprehension]

(b) Obtain the branch current, voltage drop and power across 160 ohm resistor using Mesh analysis from the circuit shown in Fig.1

[8M] (C.O.No.1) [Comprehension]



Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO (% age of CO)	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	C	
1	C.O.NO 1-5	Module 1-4	20			
2	C.O.NO 1 & 2	Module 1		12		
3	C.O.NO 3	Module 2		12		
4	C.O.NO 3	Module 3		12		
5	C.O.NO 4 & 5	Module 4, 5		12		
6	C.O.NO 3	Module 3			16	
7	C.O.NO 1, 4 and 5	Module 1, 4 and 5			16	
	Total Marks		20	48	32	100

K =Knowledge Level C = Comprehension Level, A = Application Level

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I hereby certify that all the questions are set as per the above guidelines.

SCHOOL OF ENGINEERING

SOLUTION

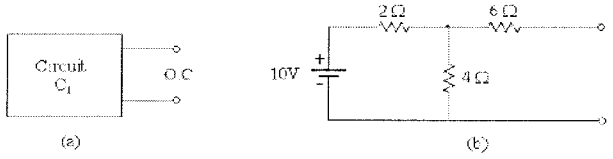
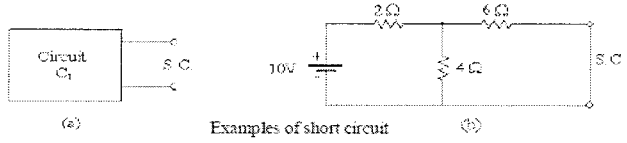
Semester: Odd Semester: 2019 - 2020 | **Date**: 30 December 2019

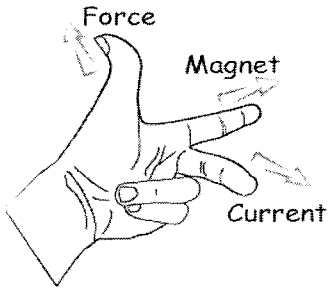
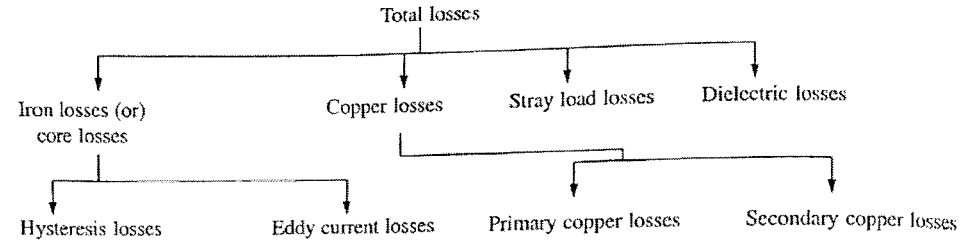
Course Code: EEE 101 | **Time**: 9:30 AM – 12:30 PM

Course Name: Elements of Electrical Engineering | **Max Marks**: 100

Program & Sem: B.Tech (ALL BRANCHES) & 1st | **Weightage**: 50 %

Part A (10Q x3M = 30Marks)

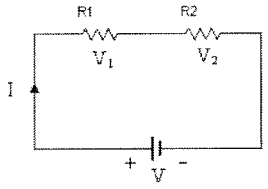
Q No	Solution	Scheme of Marking	Max Time required for each Question
1 A	5. OPEN CIRCUIT & SHORT CIRCUIT In a circuit if there is an open path or path of infinite resistance (impedance) between two nodes then that path is called open circuit. The open circuit is denoted as O.C. Since the current can flow in closed path, the current in the open circuit will be zero.  Examples of open circuit While applying KVL to closed path the open circuit can be included as an element of infinite resistance in the path, because a voltage exists between the two open nodes of a circuit. In a circuit if there is a closed path or path of zero resistance (impedance) between two nodes then that path is called short circuit. The short circuit is denoted as S.C. Since the impedance of the short circuit is zero, the voltage across the short circuit is zero.  Examples of short circuit	2M	4M
B	Average value is defined as that constant value, which produces the same amount of flux in case of voltage or same amount of charge in case of current as produced by alternating voltage or current when both are applied to the same circuit for the same period. $2V_m$	2M	4M

C	• If, somehow, connection of the coil side to the external load is reversed at the same instant the current in the coil side reverses, the current through the load will be direct current. This is what a commutator does. • The commutator is the mechanical rectifier, which changes the AC voltage of the rotating conductors to DC voltage.	2M	4M
D	• Fleming's left hand rule (for electrical motors) shows the direction of the thrust (force) on a current carrying conductor placed in a magnetic field.  	2M	4M
E	is possible with **Definition :** Transformer is a static device, which transfers the electrical power or energy from one alternating current circuit to another with the desired change in voltage or current and without any change in the frequency.  	2M	4M
F	slip speed is generally expressed as the percentage of the So slip of the induction motor is defined as the difference between the synchronous speed (N_s) and actual speed of rotor i.e. motor (N) expressed as a fraction of the synchronous speed (N_s). This is also called absolute slip or fractional slip and is denoted as 's'. Thus $s = \frac{N_s - N}{N_s}$ ... (absolute slip) The percentage slip is expressed as, $\% s = \frac{N_s - N}{N_s} \times 100$ ... (percentage slip)	2M	4M

	stator. But in a a.c. generator, the field winding is placed on rotating part (i.e. rotor) and the armature winding on the stationary part (i.e. stator). The field winding is wound around the magnetic poles. The magnetic poles are excited from direct current supplied by a d.c. source at 125 to 600 volts. Because the field magnets are rotating, the excitation current is supplied through two slip-rings. In d.c. generator the field magnets are stationary, hence the excitation current is supplied directly but not through slip-rings. In alternator the e.m.f. induced and hence the current are alternating, hence there is no need to convert into direct current. Hence, alternator does not required commutator.		
H	**IV. Classification of Measuring Instruments:** A] **Absolute Instruments:** Used only in standard Laboratories under standard atmospheric conditions and used for calibrating the secondary instruments. B] **Secondary Instruments:** These instruments are widely used in the field for all types of measurements. All the instruments discussed in this sheet are of this category. C] **Traditional Measuring Instruments:** Following are the various type of measuring instruments which were used before the advent of Digital Technology. Even now in some places these instruments are in use: 1) Depending on the quantity to be measured Volt meters, Ammeters, Watt Meters, Energy Meters, Frequency Meters, Megger 2) Depending on the working Principle: Moving Iron Type, Moving Coil type, Induction Type, Hot wire Type. 3) Depending on how the quantity is measured: Deflection Type, Integrating Type, Recording Type. D] **Modern Measuring Instruments:** 1) Digital Instruments Digital Voltmeters, Digital Multi Meters. 2) Virtual Instruments.	2M	4M
I	i. **Service Connection:** It is an Aluminum wire connected from the nearest electric pole to the House Main Switch Board. [Now days the Underground cables are used for service mains due to safety reasons.] ii. **Main Switch Board:** It is the first point where the power supply is received and distributed. This Board consists of main Fuse Units, Energy Meter, Miniature Circuit Breaker [MCB], Distribution Box. iii. **Earthing System:** An Earth pipe is installed in an earth pit and all the earth wires are connected to this pipe. iv. **Switch Boards:** It holds the Switches, Fuse Units/MCBs and the Fan Regulators. v. **Switches:** Single pole switch, Two Way Switch [Usually flush of surface type] vi. **Lamp Holders:** It is used to hold the lamps. vii. **Ceiling Roses:** This is to provide a tapping to the lamp holder to a fan point through a flexible wire. viii. **Socket Outlets:** The socket outlets will have all insulated base with moulded or socket base having three terminal sleeves. The cover is again moulded with corresponding three holes. ix. **Plugs:** These are used for tapping power from socket outlets. x. **Electrical Insulated Wires:** The insulated wires of different sizes are used to connect the switched with the power and to the load [lamp, Fan etc.]	2M	4M
J	**Need for Measurements:** 1] To quantitatively express various electrical engineering variables observed	2M	4M

	depending on the Total connected and the installations are further divided based on the voltage level at which the power is supplied as follows: i) Low Voltage Industry Installation Up to 440 Volts ii) High Voltage Industry Installations 11 K.V. &above iii) Extra High Voltage Industry Installations 110 KV and above. **B] Domestic Installations:** The power is supplied either at 230/ 220 volts or at 440 volts **C] Agricultural Installations:** Power is supplied at 440 Volts.		

Part B (4Q x 12M = 48 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
2	**Resistances in Series** In case of series connection the same current will flow through all the elements which are connected in series.  From the circuit as shown in figure $V = V_1 + V_2$ V1=IR1, V2=IR2, I=V/R1+R2, P=VI (b) Pf = 0.6 Lag. R = 30 ohms. L=0.127 H	Diagram (2M)+4 Formulae (4M) = 6M Diagram (2M) (3M)+1+1+1 = 6M	25M
3	(a) • When the armature winding of a DC motor is started rotating in the magnetic flux produced by the field winding, it cuts the lines of magnetic flux and induces the emf in the armature winding. • According to Lenz Law, whenever there is an induced EMF in a conductor, it is always in such a direction that the current it would produce would oppose the change which causes the induced EMF. • This induced EMF acts in opposite direction to the armature supply voltage • The Armature current is given by	Equation+ three loaded cases (3*2M) = 6M Three formulae (3M) + Three Answers (3M) = 6M	25M

	falls. The decreased back e.m.f allows a larger current to flow through the armature and larger current means increased driving torque. Thus, the driving torque increases as the motor slow down. c) If the load on the motor is decreased, the driving torque is momentarily in excess the requirement so that armature is accelerated.As the armature speed increases, the back e.m.f also increases and causes the armature current to decrease.The motor will stop accelerating when the armature current is just sufficient to produce the reduced torque required by the load. Hence, with the help of back EMF, the DC machine acts like a **self-regulating machine**. (b) Eb= 250V, V=260V and T=190.8N-m		
4	In Practice most of the alternators have rotating field type construction with stationary armature due to the following advantages 1. Modern alternators have armature windings designed for 6.6 *kV* or 11 *kV* or 33 *kV*. It is easier to insulate armature windings for high voltages when they are stationary. 2. It is easier to collect high currents (Say thousands of amperes) from stationary armature. 3. Keeping high voltage armature stationary, it is possible to avoid interaction of mechanical and electrical stresses. 4. Through field system rotates its voltage is very low (125 or 250 V dc) and hence it can easily supplied with the help of sliprings & brushes. 5. The problem of sparking at the sliprings can be avoided by keeping field rotating which is low voltage circuit. 6. Only two sliprings are required for dc supply to the rotor circuit. 7. The rotating field is comparatively light in weight and can run at higher speeds. 8. Overall construction is simplified with rotating field and hence high output can be obtained. 9. Cooling arrangement becomes very easy. (b) Solution.: 3 phase alternator No. of poles, $P = 10$ No. of slots $= 90$ 12 conductors/slot Speed, $N = 600$ *rpm* flux/pole, $\therefore \phi = 0.1$ *wb* Pitch factor, $K_p = 1$ (Assume full pitch coils) Distribution factor, $K_d = 0.96$ Total No. of conductors $= 90 \times 12 = 1080$ No. of conductors/phase, $Z_{ph} = \frac{1080}{3} = 360$ No. of turns / phase, $T_{ph} = \frac{360}{2} = 180$	Any 6 advantages (6M) + Star EMF and Delta EMF (3M+3M) = 12M	25M

$E_L = \sqrt{3} \times E_{ph} = \sqrt{3} \times 3836.16 = 6644.42\ V$

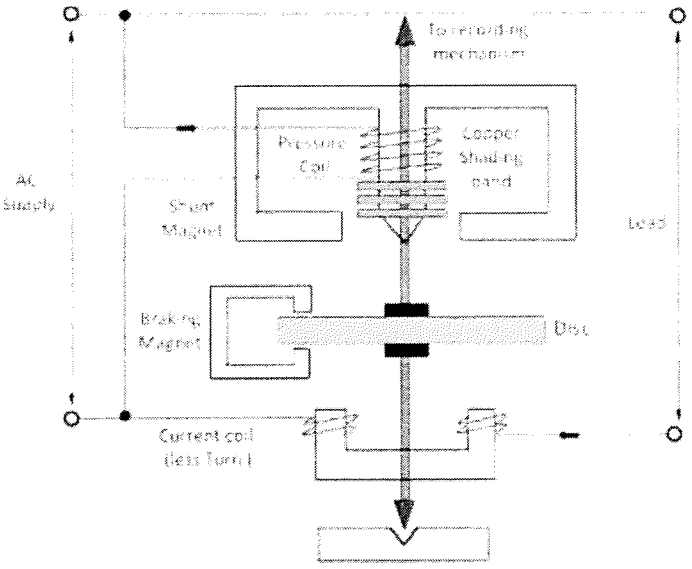
(ii) Delta Connection :

Emf induced / phase,

$E_{ph} = 4.44\ K_p\ K_d\ f\ \phi\ T_{ph} = 4.44 \times 1 \times 0.96 \times 50 \times 0.1 \times 180$

$= 3836.16\ V$

Line value of emf, $E_L = E_{ph} = 3836.16\ V$

5	(a)  The energy meter has four main parts. They are the 1. Driving System 2. Moving System 3. Braking System 4. Registering System The detail explanation of their parts is written below. 1. Driving System: The electromagnet is the main component of the driving system. It is the temporary magnet which is excited by the current flow through their coil. The core of the electromagnet is made up of silicon steel lamination. The driving system has two electromagnets. The upper one is called the shunt electromagnet, and the lower one is called series electromagnet. The series electromagnet is excited by the load current flow through the current coil. The coil of the shunt electromagnet is directly connected with the supply and hence carry the current proportional to the shunt voltage. This coil is called the pressure coil. The center limb of the magnet has the copper band. These bands are adjustable. The main function of the copper band is to	(a) Diagram (2M) + Explanation (4M) (b) Diagram (3M) + Explanation (3M)	25M

of the change of the magnetic field. This eddy current is cut by the magnetic flux. The interaction of the flux and the disc induces the deflecting torque. When the devices consume power, the aluminum disc starts rotating, and after some number of rotations, the disc displays the unit used by the load. The number of rotations the disc is counted at particular interval of time. The disc measured the power consumption in kilowatt hours.

3. Braking system:

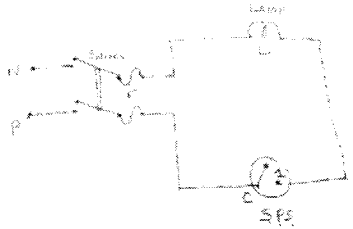
The permanent magnet is used for reducing the rotation of the aluminum disc. The aluminum disc induces the eddy current because of their rotation. The eddy current cut the magnetic flux of the permanent magnet and hence produces the braking torque. This braking torque opposes the movement of the disc, thus reduces their speed. The permanent magnet is adjustable due to which the braking torque is also adjusted by shifting the magnet to the other radial position.

Registration (Counting Mechanism):

The main function of the registration or counting mechanism is to record the number of rotations of the aluminum disc. Their rotation is directly proportional to the energy consumed by the loads in the kilowatt hour. The rotation of the disc is transmitted to the pointers of the different dial for recording the different readings. The reading in kWh is obtained by multiply the number of rotations of the disc with the meter constant.

(b)

1] To connect one lamp with single pole switch:



N= Neutrals, **P**= Phase, **F** = Fuse Unit, **SPS** = Single Pole Switch, **L**= Lamp.
P to SPS[C] = Phase wire, **SPS [1] to L** = Control Wire, **N to L** = Neutral wire.

Operation Table:

Sl. No	SWITCH POSITION	LAMP STSTUS
01	ON [C-1]	GLOWS
02	OFF [C-0]	DOES NOT GLOW