Government of Western Australia
North Metropolitan TAFE

Knowledge Portfolio

Qualification national code and title	**UEE30811 – Certificate III in Electrotechnology – Electrician**
Unit/s national code/s and title/s	**UEENEEG006A – Solve problems in single & three phase LV machines**

Portfolio of Evidence Part B Rotating Machines G006A		**Due Date**
Lecturer Name	**ANSWERS**	
Student Name		
Student ID Number		
Telephone Contact Number		**Email:**

By completing and submitting this signed form to my lecturer, I am stating that:

a. The attached submission is completely my own work
b. I understand a copy of my assessment will be kept by the NMTAFE for their records
c. I understand my assessment may be selected for use in the NMTAFE's validation and audit process to ensure student assessment meets requirements

Student Signature		**Date**	

Assessment Result Satisfactory / Not Yet Satisfactory *(please circle)* **Date:**_____

In order to satisfy requirements for this assessment, you need to complete the following:

Feedback to student: **Assessor please note: Where verbal clarification has been sought from a student to gather additional assessment evidence from an assessment item, question/s and response/s must be recorded, signed, and dated by the assessor, against the relevant assessment item/s.**

Student Feedback

Feedback from student:

Lecturer Signature: _____ **Student Signature:** _____

Date of feedback

Assessment Conditions:

Aids Permitted:
AS/NZS 3000:2018
Scientific Calculator
Notes:
Failure to submit a completed portfolio by the due date will result in re-enrolment

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Assessment Instructions:

1. Attempt ALL questions
2. Follow all instructions given by your assessor.
3. All diagrams must be neat and labelled.
4. All material handed in must have your full name on it.
5. All calculations and numerical answers must be shown correct to two decimal places and include both the unit of measurement and metric prefix if applicable.
6. If a question asks for a clause number from an Australian Standard, you must include the complete clause number.
7. Time allowed and aids permitted are indicated on the test paper.
8. Programmable and/or graphic calculators and phones are not permitted.
9. All bags, text books, pencil cases etc. must remain on the floor. Only the required pens, pencils, erasers, calculators are to be on the work surface.
10. Consult your assessor for assistance if required.
11. NO collaboration of any description between students.
12. You may not leave the assessment room without the assessor's permission. If you leave without your assessor's permission, your assessment attempt will be terminated and assessed as Not Yet Satisfactory.
13. Mobile phones must be Switched Off and placed in your bag for the duration of the assessment. If your mobile device is seen, 'rings' or vibrates during the assessment, your assessment attempt will be terminated and assessed as Not Yet Satisfactory.
14. If the assessment is interrupted for any reason, a new assessment will be attempted at a time determined by your assessor.
15. Verbal and written feedback will be given to you after the assessment.
16. A Formula Sheet is on the last page of this assessment.

Signing the Student Declaration on the* front *page indicates that you have read and agree to follow these instructions.

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Assessment Type (☑):

× Questioning (oral/written)
☐ Practical Demonstration
☐ 3rd Party Report
☐ Other (please specify)

1.	According to Flemings Right Hand Rule, if the fingers of the right hand are placed around a solenoid in the direction of current flow the thumb points in the direction of?	
	The north pole	(1)
2.	When using Fleming's left hand rule for motors the thumb points in the direction of motion and the second finger points in the direction of conventional current flow. What quantity does the first finger indicate?	
	A The north pole	
	B The south pole	
	C The direction of the magnetic lines of force	
	D None of the above	(1)
3.	The windings of a three phase induction motor are physically positioned in the stator so that they are:	
	Spaced 120º electrically from each other	(1)
4.	What 2 factors govern the speed of rotation of the rotating magnetic field in a motor?	
	Frequency and Poles	(2)
5.	What is the synchronous speed of a three phase 8pole induction motor connected to a 415v 50Hz supply? **Show all working out.**	(3)
	Nsync=120f/P (1 mark) Nsync=(120*50)/8 (1 mark) Nsync=750RPM (1 mark)	(8)

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6.	When the rotor of an Induction motor is stationary and power is applied the frequency induced into the rotor is:		
	A	Slip Speed	
	B	Maximum	
	C	Minimum	
	D	The same as when the motor is running on full load	(1)
7.	A 415V 50Hz 2 pole three phase induction motor has a name plate speed of 2880rpm. What is the motors percentage slip? **Show all working out.**		
	Nsync=120f/P (1 mark) Nsync=(120*50)/2 (1 mark) Nsync=3000RPM (1 mark) %Slip=(Ns-N)/Ns*100 (1 mark) %Slip=(3000-2880)/3000*100 (1 mark) %Slip=4% (1 mark		(6)
8.	What is the principle of operation of a three phase induction motor?		
	A	As the rotor speeds up the frequency of the current in it increases and the motor develops more torque	
	B	The magnetic flux caused by the stator current interacts with the magnetic flux caused by the rotor current in such a way that the rotor moves in the direction of the rotating magnetic field	
	C	The magnetic flux in the rotor caused by the rotor current rotates at synchronous speed and interacts with the stator magnetic flux	
	D	All of the above	(1)
9.	How can the direction of rotation of a three phase induction motor can be reversed?		
	A	Reversing any two of the incoming supply conductors	
	B	Reversing the start winding	
	C	Reversing the run winding	
	D	Reversing the rotor within the end plates	(1)
10.	Why are the rotor conductors in some squirrel cage induction motors ‘skewed’?		(1)
	A	Reduce cos Θ losses	
	B	Reduce hysteresis losses	
	C	To improve cooling	
	D	Smoother torque	(18)

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11.	A three phase induction motor has a rotor with slip rings. What type of rotor is it?	
	A wound rotor	(1)
12.	A six terminal three phase induction motor has terminals numbered U1, V1, W1, U2, V2, and W2. What terminals are connected together for star?	
	U2, V2, W2	(1)
13.	A six terminal three phase induction motor has terminals numbered U1, V1, W1, U2, V2, and W2. What terminals are connected together for delta?	
	U1 – W2 U1 – V2 U2 – V1 or U2 – W1 V1 – W1 W2 – V1	(1)
14.	When dismantling a three phase induction motor:	
	A: Care must be taken when withdrawing the rotor to ensure no damage is done to the rotor or the stator windings	
	B: The stator and end shields should be marked with whiteboard marking pen	
	C: Bearings may be placed in the tray with other parts without further protection	
	D: It is not necessary to record any defects found during dismantle	(1)
15.	When testing the insulation resistance to earth of a 415v three phase induction motor, what is the minimum acceptable reading according to AS/NZS3000:2018?	(1)
	1MΩ @ 500v	(23)

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16.	When carrying out a winding continuity test for a three phase induction motor, what meter and setting could be used?		
	A multimeter on the resistance setting An insulation resistance meter on the resistance setting		(1)
17.	As the motor load increases the torque increases and the speed decreases until the torque reaches its maximum value. If the motor load is increased further the motor will stall. This torque is called		
	A	No load torque	
	B	Breakdown torque	
	C	Full load torque	
	D	Locked rotor torque	(1)
18.	A 400v three phase 50Hz four pole induction motor has a full load speed of 1440rpm. Calculate the motors output power if it develops a torque of 75Nm. **Show all working out.**		
	$P=2\pi nT$ /60 (1 mark) $P=(2*\pi*1440*75)/60$ (1 mark) P=11.3kW (1 mark)		(3)
19.	Refer to the diagrams on the last page and identify the speed torque curve that represents a double cage induction motor in the square provided on the curve. Fig A or Fig B		(1)
20.	A three phase motor produces its maximum torque when the following condition occurs		(1)
	A	The rotor resistance equals the stator resistance	
	B	The rotor resistance equals the rotor reactance	
	C	The rotor is stationary at motor start	
	D	The motor current is at its maximum rated value	(30)

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21.	A three phase induction motor nameplate shows the motor speed as 1440rpm but when the shaft speed is measured with a tachometer the reading is 1495rpm. What is the reason for this discrepancy?	
	The motor is running with no load on the rotor shaft	(1)
22.	Name two types of three phase Induction motors that will give Improved starting torque when compared to a standard squirrel cage motor?	
	Wound rotor motor	
	Double squirrel cage induction motor	(2)
23.	The power factor and efficiency of a three phase induction motor are at their highest when the motor:	
	Is operating in a fully loaded condition	(1)
24.	Calculate the efficiency of a 5kW three phase 415V induction motor with a full load current of 10A and a power factor of 0.85 lagging.	
	$P = \sqrt{3} \times V_L \times I_L \times \lambda \times \eta$ (1 Mark) $\eta = 5000 \times 100 / (\sqrt{3} \times 415 \times 10 \times 0.85)$ (1 Mark) $\eta = 81.8\%$ (1 Mark)	(3)
25.	A three phase star connected motor runs at 2950rpm at no load. What would be the approximate no load speed of the same motor connected in delta.	
	2950rpm	(1)
26.	Why can an Induction motor not run at synchronous speed?	
	A Because of the friction in the rotor bearings	
	B There would be no rotor current	
	C The stator currents would be too high	
	D All of the above	(1)
27.	A Delta connected three phase Induction motor has the following measurements taken at the motor terminal block with the motor links still connected: U_1 to U_2 = 10Ω V_1 to V_2 = 5Ω W_1 to W_2 = 5Ω What is the condition of the motor?	(2)
	A Open circuit in the U winding.	
	B Short circuit between U and V windings.	
	C Open circuit in W winding.	
	D The motor tests O.K.	(41)

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28.	What are 3 types of single phase induction motors?		
	Split phase Cap start cap run Permanent capacitor Series universal Shaded pole		(3)
29	A three phase induction motor nameplate shows a STAR connection diagram. Can this motor be run safely and efficiently in the DELTA configuration?		
	A	Yes	
	B	No	(1)
30.	Why does the current in the run winding of a split phase induction motor lag the current in the start winding?		
	The run winding is embedded deep in the stator and has higher inductance.		(1)
31.	The torque produced by an Induction motor is directly proportional to:		
	A	The rotor resistance	
	B	The square of the applied voltage	
	C	The line current	
	D	The applied voltage	(1)
32.	If a three phase Induction motor loses one phase while running on NO load what would be the likely outcome:		
	A	The motors overload mechanism would activate	
	B	The motor would continue to run	
	C	The motors line current would decrease	
	D	The motor would slow down and stop	(1)
33.	Give an example of a single phase motor that does not operate on the split phase principle?		(1)
	Series universal Shaded pole		(49)

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34.	Name two methods of automatically disconnecting the start winding in a capacitor start motor:		
	Centrifugal switch, timer, electromagnetic mechanism, thermal mechanism.		(2)
35.	If a capacitor start motor is tested for winding resistance with all the connections correctly made and the resistance reading was open circuit it would Indicate what fault:		
	A	Open circuit start winding	
	B	Open circuit run winding	
	C	Open circuit centrifugal switch	
	D	Start and run winding shorted together	(2)
36.	State the three situations where a motor switching device need not be provided : State AS/NZS 3000:2018 clause number.		
	Motors that are: Connected by a plug and socket outlet Incorporated in an appliance having no exposed moving parts Rated at not greater than 150VA		
	Clause No:**4.13.1.1 exception 2**		(4)
37.	A shaded pole motor with a rating of 580VA need not be provided with an over-temperature device: State AS/NZS 3000:2018 clause number.		
	A	True	
	B	False	
	Clause no;4.13.3.1		
38.	Which device would provide protection in the event of an Under-voltage condition in a motor?		
	A	Magnetic Contactor	
	B	Voltage dependent resistor	
	C	Thermal Overload	
	D	Microtherm	(1)
39.	State the component that is embedded in a motor winding and used in conjunction with a specially designed electronic circuit to provide over-temperature protection.		(1)
	Thermistor		(59)

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40.	State the four factors that govern the output voltage of an alternator	
	Speed of rotation	
	Flux density	
	Number of turns	
	Angle at which coil cuts the magnetic flux	(4)
41.	What is the relationship between the rotor and the rotating magnetic field in a synchronous motor?	
	They run at the same speed	(1)
42.	Why is the stator core of a split phase motor laminated?	
	To reduce eddy currents	(1)
43.	The centrifugal switch should disconnect the start winding when the rotor reaches	
	75% of rated speed	(1)
44.	Split phase induction motors are best suited to power	(1)
	A Refrigeration compressors	
	B Washing machines	
	C Multi –speed air conditioner fans	
	D Vacuum cleaner	(67)

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45.	How can the rotational direction of a split phase motor be reversed?		
	Reverse either start or run winding		(1)
46.	A capacitor start motor has the capacitor in series with which 2 other components?		
	Centrifugal switch and start winding		(2)
47.	A capacitor start capacitor run motor will have which components?		
	A	A run winding, an auxiliary winding, a centrifugal switch and two capacitors of different values	
	B	A run winding, an auxiliary winding and a centrifugal switch	
	C	A run winding, an auxiliary winding and a capacitor but no centrifugal switch	
	D	A run winding, an auxiliary winding, a centrifugal switch and two capacitors of the same value	(1)
48.	A permanent split capacitor motor will have which components?		
	A	A run winding, an auxiliary winding, a centrifugal switch and two capacitors of different values	
	B	A run winding, an auxiliary winding and a centrifugal switch	
	C	A run winding, an auxiliary winding and a capacitor but no centrifugal switch	
	D	A run winding, an auxiliary winding, a centrifugal switch and two capacitors of the same value	(1)
49.	Which of the following best describes a shaded pole motor?		(1)
	A	A run winding, an auxiliary winding, a centrifugal switch and two capacitors of different values	
	B	A run winding, an auxiliary winding and a centrifugal switch	
	C	A run winding, an auxiliary winding and a capacitor but no centrifugal switch	
	D	A salient pole stator with copper rings embedded into a part of the pole face and a squirrel cage rotor	(73)

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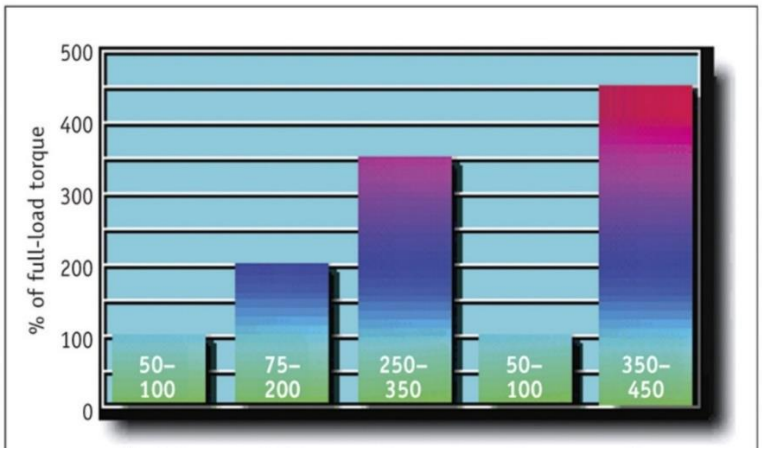
50.	Explain the principle of operation of a single phase induction motor. A rotating magnetic field is created by having two windings that are electrically out of phase with each other	(1)
51.	Explain the principle of operation of a shaded pole motor. A rotating magnetic field is created by interaction between magnetic flux produced in the main field poles and magnetic flux produced by current flowing in the shading ring	(1)
52.	Refer to the characteristic chart below and label each bar of the bar graph with the correct motor type from the list below	
	A Capacitor start motor	
	B Split phase motor	(5)
	C Capacitor start capacitor run motor	
	D Permanent capacitor motor	
	E Shaded pole motor	(80)



Shaded pole | Split phase | Cap start | Perm cap | Cap start cap run

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53.	Capacitor start motors are best suited to power:		
	A	Refrigeration compressors	
	B	Washing machines	
	C	Multi –speed air conditioner fans	
	D	Vacuum cleaner	
	E	Domestic exhaust fans	(1)
54.	Capacitor start capacitor run motors are best suited to power		
	A	Wall mounted air conditioning compressors	
	B	Washing machines	
	C	Multi –speed air conditioner fans	
	D	Vacuum cleaner	
	E	Domestic exhaust fans	(1)
55.	Permanent capacitor motors are best suited to power		
	A	Refrigeration compressors	
	B	Washing machines	
	C	Multi –speed air conditioner fans	
	D	Vacuum cleaner	
	E	Domestic exhaust fans	(1)
56.	Shaded pole motors are best suited to power		
	A	Refrigeration compressors	
	B	Washing machines	
	C	Multi –speed air conditioner fans	
	D	Vacuum cleaner	
	E	Domestic exhaust fans	(1)
57.	Capacitor start, capacitor start capacitor run and permanent capacitor motors can have their direction of rotation reversed by reversing the connections to either the start or run windings but not both. True or false?		(1)
	True		(85)

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58.	A series universal motor has the same basic construction as a d.c. series motor and the same operating principle. True or false?		
	True		(1)
59.	How are the field coils connected to the armature coils in a series universal motor?		
	Via the commutator and carbon brushes		(1)
60.	Series universal motors are best suited to power		
	A	Refrigeration compressors	
	B	Washing machines	
	C	Multi –speed air conditioner fans	
	D	Vacuum cleaner	
	E	Domestic exhaust fans	(1)
61.	Why do motors require protection against both overload and faults?		
	They often run unattended and need to be disconnected from supply before they are damaged		(1)
62.	In order to fully satisfy all of the requirements of AS/NZS3000:2018, motors must incorporate protection against what?		(1)
	Against injury from mechanical movement, overload and over temperature		(90)

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63.	According to the AS/NZS3000:2018, motors must be protected against overload if rated greater than what power rating?		
	370W		(1)
64.	Overload protection devices can be classified as either thermal or electromagnetic and should be set to the full load current rating of the associated motor. True or False?		
	True		(1)
65.	Thermal overloads and microtherm devices such as klixons operate on what principle?		
	Bi –metallic strips bending when exposed to heat		(1)
66.	HRC fuses used to protect motor circuits against short circuits		
	A	Should be capable of providing protection whilst not tripping on motor starting currents	
	B	Also provide protection against over temperature	
	C	Also protect the load	
	D	All the above	(1)
67.	What type of protection do Voltage dependent resistors provided?		
	Protection against over voltage		(1)
68.	Motors that are subject to repetitive starting or frequent reversing need to be specially designed because:		(1)
	A	The load can break	
	B	The voltage spikes generated will damage the motor	
	C	The HRC fuses will be subjected to excessive thermal aging	
	D	The high temperatures caused can damage the winding insulation	(96)

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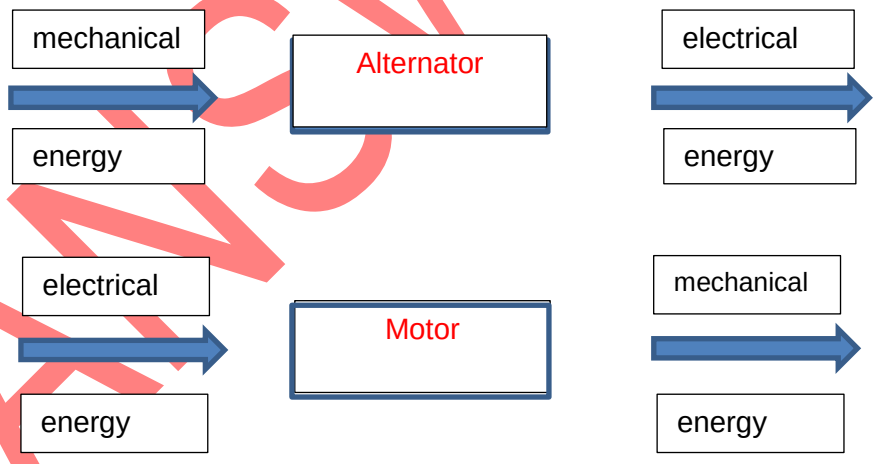
69.	Which type of motor is best suited for use in an areas of high humidity, high temperature and/or corrosive atmospheres?	
	Ducted or force ventilated motor	(1)
70.	Phase failure protection is achieved for larger motors by installing voltage sensitive relays across each phase with contacts in the motors control circuit. True or false?	
	True	(1)
71.	The overloads for a particular motor starter combination should be selected taking into account what value on the motor nameplate?	
	The motors full load current	(1)
72.	Label the electrical machine power transfer diagrams below to indicate the device type.	(2)
		(101)

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73.	A particular single phase alternator has a permanent magnet rotor and a 2 pole distributed winding in the stator. If the rotor is driven at a constant speed what type of output will this alternator have?		
	A sine wave		(1)
74.	A synchronous motor is designed so that the rotor :		
	A	And the rotating magnetic field move at the same speed	
	B	And the rotating magnetic field move at different speeds depending on the load	
	C	And the rotating magnetic field move at different speeds depending on the slip percentage	
	D	And the rotating magnetic field produce a lagging power factor	(1)
75.	For a three phase induction motor to be used an asynchronous generator a prime mover must drive the rotor :		
	A	At synchronous speed	
	B	At the rated name plate speed of the motor (slip speed)	
	C	At a higher speed than the synchronous speed	
	D	None of the above because a motor cannot be used as a generator v	(1)
76.	What are 4 of the main parts of a synchronous alternator/motor?		
	Stator Rotor Windings Brush gear Bearings End plates		(4)
77.	Alternators that are fitted with a bridge rectifier on their rotor shaft are known as:		(1)
	A	Self-excited alternators	
	B	Brushless excited alternators	
	C	Separately excited alternators	
	D	Automatically voltage regulated alternators	(109)

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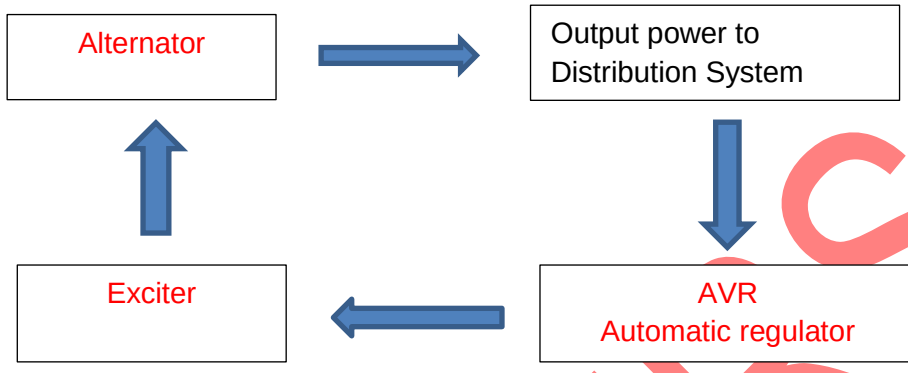
78.	Label the diagram below to indicate voltage control for an Alternator by placing the terms Alternator, Exciter and Voltage Regulator in the correct rectangle.	
		(3)
79.	The reason large peak period loads are generally supplied by several alternators operating in parallel is because:	
	A: One alternator large enough to supply the load will be too costly	
	B: This provides flexibility to shut down an alternator during periods of lower demand and for maintenance	
	C: Alternators have a maximum output size and if the load is bigger you need more than one	
	D: Prime movers have limited output power and cannot drive big alternators	(1)
80.	Large three phase synchronous motors may have their rotor dc windings short circuited to become an induction motor and then have the short removed and dc applied to the rotor. What is the reason for this?	
	Large synchronous motors cannot self-start	(1)
81.	If the dc output voltage of an alternator's exciter increases, what will happen to the alternators AC output voltage?	(1)
	It will increase	(115)

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82.	At what speed would a 4 pole three phase portable alternator have to be rotated to produce an output frequency of 60Hz. Show working out.		
	N = $\frac{120\ x\ 50}{4}$ = 1800 RPM		(3)
83.	Varying the speed to the rotor of a synchronous alternator has the following effect :		
	A	The speed of the generator can be altered	
	B	The output voltage will be altered	
	C	The output frequency will be altered	
	D	The power factor of the stator current can be altered	(1)
84.	A three phase wound rotor motor can be run as a synchronous motor?		
	A	True	
	B	False	
85.	Label the curves below to indicate the effects of loads with unity, lagging and leading power factors.		(3)
			(122)

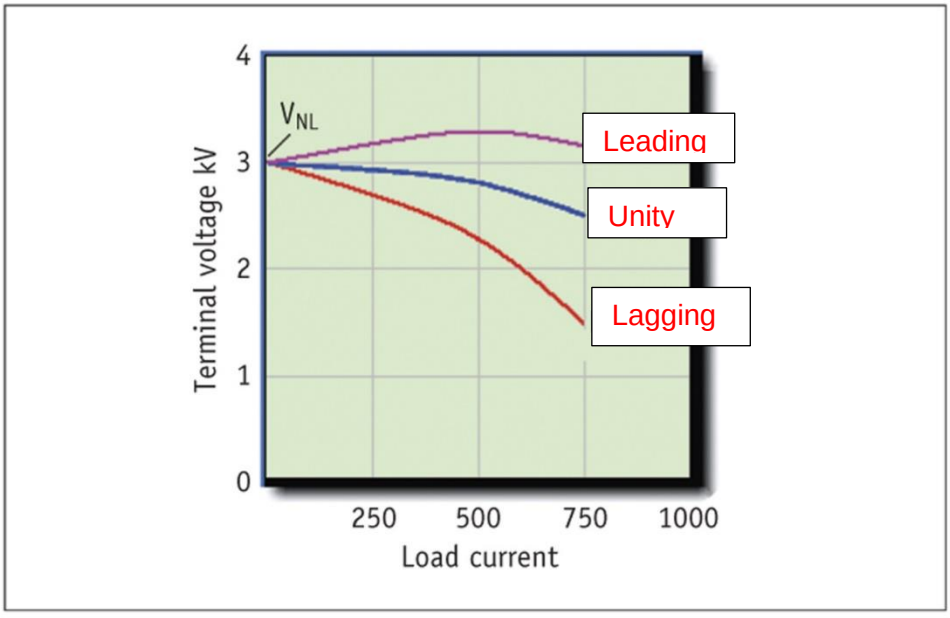

Figure 6.148 Regulation curves

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86.	Which of the following is the most suitable prime mover for a portable three phase alternator?		
	A	A steam turbine	
	B	A petrol or diesel internal combustion engine	
	C	A water turbine	
	D	A gas turbine	(1)
87.	When manually adjusting the output of a standby alternator it is important		
	A	To adjust the engine speed (frequency) and then the output voltage	
	B	To adjust the output voltage and then the engine speed(frequency)	
	C	To adjust the output voltage only	
	D	To adjust the engine speed only	(1)
88.	Why are alternators rated on VA and not Watts?		
	Because the load power factor will vary		(1)
89.	You are required to supply an alternator for backup power to a hospital so their operating theatre can continue operating if the mains power fails. Which of the following is the most suitable?		
	A	A steam powered alternator	
	B	A diesel powered alternator	
	C	A gas turbine powered alternator	
	D	A wind powered alternator	(1)
90.	Diesel powered standby alternators are most like to have		(1)
	A	A cylindrical rotor	
	B	A squirrel cage rotor	
	C	A salient pole rotor	
	D	A double cage rotor	(127)

Knowledge Portfolio

Qualification national code and title	**UEE30811 – Certificate III in Electrotechnology – Electrician**
Unit/s national code/s and title/s	**UEENEEG006A – Solve problems in single & three phase LV machines**

91.	If a self-excited single phase alternator fails to produce any output voltage at its output terminals with its prime mover running what is the most likely cause?	
	Loss of residual magnetism	(1)

TOTAL MARKS	SCORE	%
128		

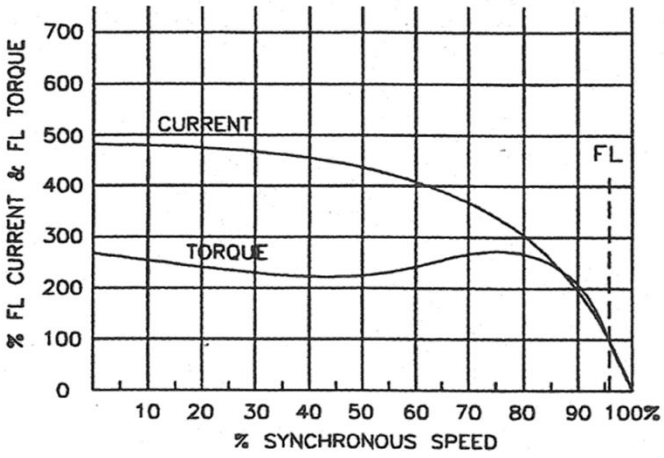

Fig A

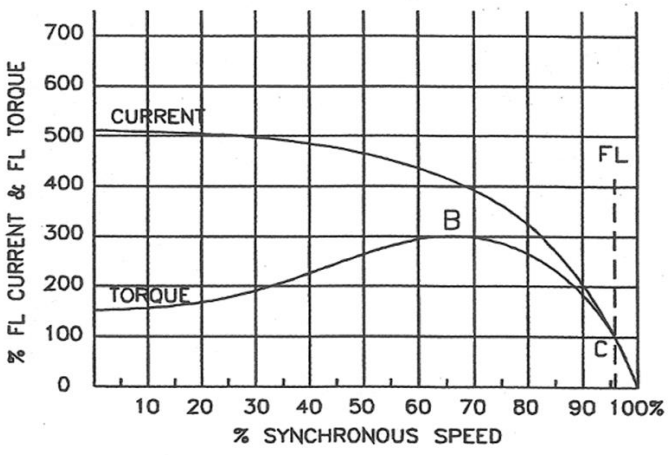

Fig B