Roll No												

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Semester: Odd Semester: 2019 - 20
Course Code: EEE 304
Course Name: ELECTRICAL DRIVES
Program & Sem: B.Tech (EEE) & VII (DE-III)

Date: 20 December 2019
Time: 9.30 AM to 12.30 PM
Max Marks: 80
Weightage: 40%

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 Questions]

Answer all the sub Questions. Each sub Question carries 02 marks. (10Qx2M=20M)

1. a) Specify the functions of power modulator (C.O.No.1) [Knowledge]
   b) What are the conventions of speed and torque in Forward Braking and Reverse Motoring Modes? (C.O.No.1) [Knowledge]
   c) Classify the different methods of braking applied to the DC motor (C.O.No.2) [Knowledge]
   d) Type-A chopper has following specifications DC source voltage of 220V, total time period is 20 mSec and Turn off period is 5msec. Calculate output voltage and duty cycle? (C.O.No.2) [Knowledge]
   e) Compute the %slip of 3.2kW, 1440 rpm, 4 poles and 50 Hz three phase induction motor? (C.O.No.3) [Knowledge]
   f) A three phase, 50 Hz, 4 pole induction motor is controlled from a stator voltage regulator. The motor is running at a speed of 1000 rpm. Neglecting the core loss and stator impedance, the % efficiency of the motor will be. (C.O.No.3) [Knowledge]
   g) The maximum value of torque angle (δ) for a synchronous motor is _____ (C.O.No.4) [Knowledge]
   h) What is the value of pull out torque angle of a synchronous motor during braking region? (C.O.No.4) [Knowledge]
   i) What are the different types of drives used in cement industry? (C.O.No.5) [Knowledge]
   j) List out the different operating sections used in paper mills? (C.O.No.5) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each Question carries 07 marks. (4Qx7M=28M)

2. In a class room, the speed of the fan is controlled by a regulator called TRIAC, consider this as an example of an electric drive, identify the various parts of the electric drive and explain the each part in detail.

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

3. A 220V, 10.5A, 1300rpm DC shunt motor is used for wood cutting application and its armature resistance is 0.5Ω. It is required to carve the wood piece at 1000rpm at half the rated torque. The motor is controlled by single phase fully controlled rectifier with an AC source voltage of 230V, 50Hz. It is observed that the motor is running in reverse direction with the rated speed.

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

i) Identify the problem in the rectifier control circuit
ii) Mention the steps to be taken to rotate the motor in positive direction
iii) Compute the firing angle to run the motor at 1000rpm with half rated torque.

4. An induced draft (ID) fan is controlled by stator voltage control. The ID fan motor is having the following specifications 2.8KW, 400V, 50Hz,4 pole, 1370rpm, delta connected squirrel cage induction motor has following parameters referred to the stator: R_s=2Ω, R_r'=5Ω, X_s=X_r'=5Ω, X_m=80Ω,. When driving a fan load it runs at rated speed at rated voltage. Compute the values of motor terminal voltage, current & torque at 1200 rpm.

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

5. A 400 kW, 3-phase, 3.3 kV, 50 Hz, 0.85(lagging) power factor, 4 pole, star connected synchronous motor which is driving low speed compressors has the following parameters: X_s=15 Ω,R_s=0 Ω. Rated field current is 10A. Compute the armature current of the motor and the power factor at half rated torque and rated field current.

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

Part C [Problem Solving Questions]

Answer all the Questions. Each Question carries 08 marks. (4Qx8M=32M)

6. A drive has following equations for the motor and load torques:
$T = (1 - 2\omega_m)$ and $T_l = -3\sqrt{\omega_m}$ obtain the equilibrium points. Analyze results and determine their steady state stability.

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

7. A 230V, 960rpm and 200A separately excited motor has the armature resistance and inductance of 0.02Ω. The Motor is controlled both in motoring and regenerative braking modes by a chopper. The source has the DC voltage of 230V. Assuming continuous conduction
(a) Calculate duty ratio of chopper for motoring operation at rated torque and 350 rpm
(b) Calculate duty ratio of chopper for braking operation at rated torque and 350 rpm.

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

8. A 440 V, 50 Hz,970 rpm, 6 pole, star connected, slip ring induction motor has the following parameters: R_s=0.1Ω,R_r'=0.08Ω,X_s=0.3Ω, X_r'=0.4Ω,X_m can be neglected. Stator to rotor turns ratio is 2. The motor speed is controlled by static Krammer drive. The drive is designed for a speed range of 25% below synchronous speed. Maximum value of firing angle is 165^0.

   Compute i) Transformer turns ratio

   ii) Torque for a speed of 780 rpm and $\alpha = 140^0$

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

9. a) A 1492 kW ,unity power factor,3-phase ,star-connected ,2300 V, 50 Hz, synchronous motor has a synchronous reactance of 1.95 ohm/phase. Compute the maximum torque in N-m which this motor can deliver if it is supplied from a constant frequency source and if the field excitation is constant at the value which would result in unity power factor at rated load. Assume that the motor is of cylindrical rotor type. Neglect all losses.

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

   b) Classify the drives used in cement industry and explain them in detail.

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

GAIN MORE KNOWLEDGE
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SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

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	CO 01 CO 02 CO 03 CO 04 CO 05	All modules	20 (4+4+4+4+4)			20
2	CO 01	Module-1		7		7
3	CO 02	Module-2		7		7
4	CO 03	Module-3		7		7
5	CO 04	Module-4		7		7
6	CO 01	Module-1			8	8
7	CO 02	Module-3			8	8
8	CO 03	Module-3			8	8
9	CO 04& CO 05	Module-4			(4+4)	8
	Total Marks		20	28	32	80

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 guidelines.

Faculty Signature:

Reviewer Commend:

Format of Answer Scheme

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

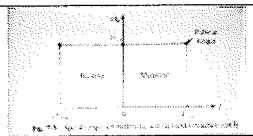
SCHOOL OF ENGINEERING

SOLUTION

Semester: Odd Sem. 2019-20
Course Code: EEE 304
Course Name: Electrical Drives
Program & Sem: B.Tech (EEE) & VII

Date: 20 December 2019
Time: 9.30 AM to 12.30 PM
Max Marks: 80
Weightage: 40%

Part A (10Q x 2M = 20Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1 a).	Fans,Compressors,ship-propellors	**2M**	**3Min**
1 b).	$T = T_l$	**2M**	**3Min**
1 c).	Dynamic, Regenerative and Plugging	**2M**	**3Min**
1 d).	1561rpm	**2M**	**3Min**
1 e).	0.066	**2M**	**3Min**
1 f).	172.5 N-m	**2M**	**3Min**
1 g).	90^0	**2M**	**3Min**
1 h).		**2M**	**3Min**
1 i).	Raw mill and cement mill drives, kiln drives, crusher drives, waste gas fan drives and compressor drives	**2M**	**3Min**
1 j).	Couch section, press section, dryer section, calendar and reel section	**2M**	**3Min**

Part B (4Q x 7M = 28 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
2	Driving the uphill (angle of inclination), Forward Motoring and Forward Braking, Speed- Torque conventions, Driving in reverse direction, Reverse Motoring and Reverse Braking, Speed- Torque conventions Draw four quadrants of Speed and Torque plane.	• Understanding the multi quadrant operation(2M) • Explanation of the speed-torque conventions while driving from Point A to Part B(Acceleration and Braking)/ Forward Motoring and Forward Braking (2M) • Explanation of the speed-torque conventions while driving from Point B to Part A(Reverese Acceleration and Reverse Braking)/ Reverse Motoring and Reverse Braking, Draw four quadrants of Speed and Torque plane (3M)	18Min
3	• The problem of the motor is, the firing angle of the rectifier is 1800. Since the firing angle is 1800, the motor is rotating in reverse direction. • Firing angle= 70.34^0	Problem Identification(2M) Computation of speed, back emf(3M) Computation of Firing angle(2M)	18Min
4	Synchronous speed= 1500rpm Slip= 0.0867 New slip= 0.2 Load Torque=36.9N-m V=253.2V Line current=17.89A	Synchronous speed= 1500rpm(1M) Slip= 0.0867 (1M) New slip=0.2 Load Torque=36.9N-m(2M) V=253.2V(2M) Line current=17.89A(1M)	18Min
5	Rated armature current= 109.3 Rated power factor = 0.8lag Excitation voltage= 1603 L-54.90 V New armature current= 52.75, angle -54.90 Power factor 0.34 lagging	Rated armature current= 109.3(2M) Rated power factor = 0.8lag Excitation voltage= 1603 L-54.90 V(2M) New armature current= 52.75, angle -54.90 (3M) Power factor 0.34 lagging	18Min

Part C (4Q x 8M = 32 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6	J=7.457 kg-m^2 T=7.93N-m P=830.35W	Computing the value of equivalent Moment of Inertia (2M) Computing the value of equivalent Torque (4M) Computing the value of Power (2M)	19Min
7	Back Emf at rated speed = 226V Back Emf at 600rpm=141.25V Duty cycle=0.83	Back Emf at rated speed = 226V (2M) Back Emf at 600rpm=141.25V(3M) Duty cycle=0.83(3M)	20 Min
8	Related formula for max slip Modified expression for slip after adding the external resistance Computation of Resistance to be inserted per phase	Related formula for max slip (2M) Modified expression for slip after adding the external resistance (2M) Computation of Resistance to be inserted per phase (4M)	19Min
9 a)	E= 1515.489 Volts P max=1032.014 kW/phase T max =3285 N-m Total Torque for three phases= 9855 N-m	E= 1515.489 Volts P max=1032.014 kW/phase(2M) T max =3285 N-m Total Torque for three phases= 9855 N-m(2M)	10Min
9 b)	Classifications and explanation of drive	Classifications and explanation of drive(4M)	10Min

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PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST – 2

Sem & AY: Odd Sem 2019-20 | **Date**: 16.11.2019

Course Code: EEE 304 | **Time**: 9:30 AM to 10:30 AM

Course Name: ELECTRICAL DRIVES | **Max Marks**: 40

Program & Sem: B.Tech (EEE) & VII (DE) | **Weightage**: 20%

Instructions:

(i) *Read the question properly and answer accordingly.*

(ii) *Question paper consists of 3 parts.*

(iii) Scientific and Non-programmable calculators are permitted

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Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries one and half marks. (4x1.5M=6M)

1. Write down the expression for average output voltage for Type-A chopper? (C.O.NO.2) [Knowledge]
2. Is it possible to get Multi quadrant operation from fully controlled rectifier? Justify (C.O.NO.2) [Knowledge]
3. Write the expression for maximum average output voltage of three phase fully controlled rectifier? (C.O.NO.2) [Knowledge]
4. Speed control of a three-phase induction motor is more difficult than D.C. motors. Justify? (C.O.NO.3) [Knowledge]

Part B [Thought Provoking Questions]

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

5. A 220V, 50A, 1300rpm DC shunt motor is used to run conveyor belt. Its armature resistance is 0.5Ω. It is required to transport coal using conveyor belt at 1000rpm and the twice the torque. The motor is controlled by three phase fully controlled rectifier with an ac source voltage of 440 V, 50Hz. It is observed that the motor is running in reverse direction at half rated speed.
   Identify the problem in the rectifier control circuit and explain the steps to rotate the motor in positive direction at the twice torque and with speed of 1000rpm.
   (C.O.NO.2) [Comprehension]

Part C [Problem Solving Questions]

Answer both Questions. Each Question carries twelve marks. (2Qx12M=24M)

6. A 230V, 960rpm and 200A separately excited motor has the armature resistance and inductance of 0.02Ω. The Motor is controlled both in motoring and regenerative braking modes by a chopper. The source has the DC voltage of 230V. Assuming continuous conduction
   (a) Calculate duty ratio of chopper for motoring operation at rated torque and 350 rpm
   (b) Calculate duty ratio of chopper for braking operation at rated torque and 350 rpm.
   (C.O.NO 2) [Comprehension]

7. A 2.8 kW, 400V, 50Hz,4 pole, 1370rpm, star connected squirrel cage induction motor has following parameters referred to the stator: Rs=2Ω, Rr'=5Ω, Xs=Xr'=5Ω, Xm=80Ω,motor speed is controlled by stator voltage control. When driving a pump load it runs at rated speed at rated voltage.
   Calculate i) motor terminal voltage, current & torque at 1300 rpm.
   (C.O.NO.3) [Comprehension]

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE REACH GREATER HEIGHTS

Semester: VII

Course Code: EEE 304

Course Name: **Electrical Drives**

Date: 16-11-2019

Time: 9:30AM-10:30AM

Max Marks: 40

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	C		
PART-A	C.O.1&2	Module2(3/4th) & Module 3(1/4th)	1 1.5M	2 1.5M	3 1.5M	4 1.5M				**6M**
PART B	C.O.1&2	Module2(3/4th) & Module 3(1/4th)					1 10 M			**(1X10M) 10M**
PART C	C.O.1&2	Module2(3/4th) & Module 3(1/4th)						1 12M	2 12M	**(2X12M) 24M**
	Total Marks									**40M**

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: Format of Answer Scheme

SCHOOL OF ENGINEERING

SOLUTION

Semester: VII

Course Code: EEE 304

Course Name: **Electrical Drives**

Date: 16-11-2019

Time: 9:30AM-10:30AM

Max Marks: 40

Weightage: 20%

Part A (4 x 1.5 = 6Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	Vo= α Vs	**1.5M**	**2.5min**
2	Yes, Justification in terms of signs of average output voltage.	**1.5M**	**2.5min**
3	$V_o = \frac{3\sqrt{3}V_m}{\pi} Cos\alpha$	**1.5M**	**2.5min**
4	Justification in terms of control methods	**1.5M**	**2.5min**

Part B (1x 10M = 10M)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	• The problem of the motor is, the firing angle of the rectifier is 180^0. Since the firing angle is 180^0, the motor is rotating in reverse direction. • Firing angle= 70.34^0	Problem Identification(4M) Computation of speed, back emf(3M) Computation of Firing angle(3M)	16min

Part C (2 x 12M = 24Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	i) Back Emf at rated speed = 226V Back Emf at 350rpm=82.4V Terminal voltage at 350rpm= 86.4V Duty cycle=0.376 ii) Back Emf at rated speed = 226V Back Emf at 350rpm=82.4V Terminal voltage at 350rpm= 78.4V Duty cycle=0.34	i) Back Emf at rated speed = 226V Back Emf at 350rpm=82.4V Terminal voltage at 350rpm= 86.4V Duty cycle=0.376 **(6M)** ii) Back Emf at rated speed = 226V Back Emf at 350rpm=82.4V Terminal voltage at 350rpm= 78.4V Duty cycle=0.34**(6M)**	17min
2	a) Stator voltage control advantages b) Synchronous speed= 1500rpm Slip= 0.0867 Load Torque=36.9N-m V=253.2V Line current=17.89A	c) Stator voltage control advantages(4M) d) Synchronous speed= 1500rpm(1M) Slip= 0.0867 (1M) Load Torque=36.9N-m(2M) V=253.2V(2M) Line current=17.89A(2M)	17min

Roll No.													

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SCHOOL OF ENGINEERING

TEST – 2

Sem & AY: Odd Sem 2019-20
Course Code: MEC 304
Course Name: PRODUCTION PLANNING AND CONTROL
Program & Sem: B.Tech & VII (DE)

Date: 16.11.2019
Time: 9.30 AM to 10.30 AM
Max Marks: 40
Weightage: 20%

Instructions:

(i) All questions are compulsory
(ii) Scientific calculators are allowed.

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries three marks. (4Qx3M=12M)

1. Define Process planning and Production Planning. (C.O.NO.3) [Knowledge]
2. List any six differences between Quality control and Quality Assurance. (C.O.NO.2) [Knowledge]
3. Define Value Analysis and Value Engineering. (C.O.NO.3) [Knowledge]
4. Draw a neat flow chart for process plan. (C.O.NO.3) [Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each Question carries six marks. (2Qx6M=12M)

5. Explain how QC tools help in Practical application. Explain any 2 types of them with neat sketch. (C.O.NO.2) [Comprehension]
6. Explain the phases of value analysis with flow chart taking a real time example. (C.O.NO.3) [Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each Question carries eight marks. (2Qx8M=16M)

7. A product is sold at a rate of 400pieces /day and is manufactured at a rate of 200 pieces/day. The setup cost of the machines are Rs 5000 and the storage cost are found to be Rs 0.015 per unit per day. Labour charges are Rs 120, material charges are Rs 80 and overheads Rs 160 per piece. If the interest charges are 13%. Find the minimum cost batch size and the cost of the production run. Assume 300 working days in a year.

(C.O.NO.3) [Application]

8. A product has to undergo 10 stages in the production sequence. Table below shows the preparation time and the machine time for those 10 stages.

Operation	1	2	3	4	5	6	7	8	9	10
Preparation time (min)	0.2	0.4	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.6
Machine time (min)	0.8	9.6	0.4	0.9	1.3	4.6	2.2	2.6	2.4	3.0

i) Determine the total operation time, cycle time, the output of the line and the efficiency of the actual given production line.

ii) It is required that the production time to be reduced to 5 min. Explain how it can be accomplished

iii) Also determine the output and the efficiency of the new cycle.

(C.O.NO.3) [Application]

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

Semester: 7

Course Code: MEC304

Course Name: **Production Planning and Control**

Date: 17.11.2019

Time: 11:00-12:00

Max Marks: 40

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	Co3	3	3									
2	Co2	2	3									
3	Co3	3	3									
4	Co3	3	3									
5	Co2	2				6						
6	C03	3				6						
7	C03	3							8			
8	C03	3							8			
	Total Marks		12			12			16			40

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

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

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Annexure- II: Format of Answer Scheme

GAIN MORE KNOWLEDGE REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

SOLUTION

Semester: 7

Course Code: MEC304

Course Name: Production Planning and control

Date: 17.11.19

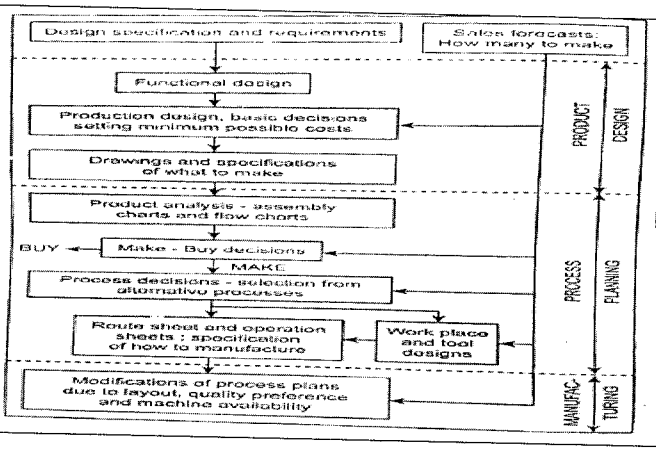
Time: 11-12 pm

Max Marks: 40

Weightage: 20%

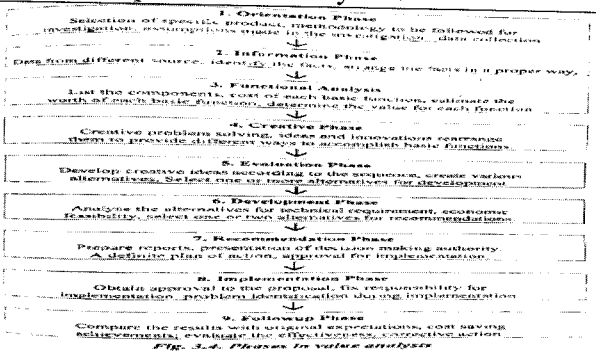
Part A (4Qx3M = 12Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	• **Define :** Definition: It is an act of preparing a detailed processing documentation for the manufacture of a piece part or assembly Or • **It is the systematic determination of the methods by which a product is to be manufactured economically and competitively** **Process panning:It is concern with the technology and engineering issues** **How to make the product and its parts** **Production planning:Concerned with the ordering the resources required to make the product** **Logistic issues of product**	**Define=1.5 marks each**	**5mins**
2	**Difference between QA and QC**	**Any 6 differences=3M**	**5mins**
3	• **Value analysis is a application of a set of techniques to an existing product with a view to improve its value. Thus value analysis is the remedial process**	**Each Definition=1.5M**	**5mins**

	• **Value engineering is the application of exactly same set of techniques to a new product at the design stage itself. Therefore value engineering is a preventive process**		
4		**Each step =0.5 M**	**5mins**

Part B

(2Q x 6M = 12 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
5	QC tools • Stratification • Histogram • Check Sheet (Tally Sheet) • Cause-and-effect diagram • Pareto chart • Scatter diagram • Control chart Explaination of any two	Explaination= 2M Graph =4M	12.5mins
6	 Fig. 3.4. Phases in value analysis Explaination with real time example	Diagram =3M Explaination=3M	12.5mins

Part C (2Q x 8M = 16Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
7	Solution:Qm=4292,Ym=362,YmQm=1555120	Qm 3marks.Ym 3 marks,QmYm 2.5 marks	7.5mins
8	Total Operation Time= 30.2 Min, Cycle Time=10 min,Qth=6 Units /hr, efficiency=30.2, Qth=12 units/hr, Efficiency=54.5%	Cycle time, output ,efficiency for 10 min—4marks Cycle time, output ,efficiency for 5 min—4marks	7.5mins

Elaborated Solution is required.

Roll No												

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REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Semester: Odd Semester: 2019 - 20
Course Code: EEE 304
Course Name: ELECTRICAL DRIVES
Program & Sem: B.Tech (EEE) & VII (DE-III)

Date: 20 December 2019
Time: 9.30 AM to 12.30 PM
Max Marks: 80
Weightage: 40%

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 Questions]

Answer all the sub Questions. Each sub Question carries 02 marks. (10Qx2M=20M)

1. a) Specify the functions of power modulator (C.O.No.1) [Knowledge]
   b) What are the conventions of speed and torque in Forward Braking and Reverse Motoring Modes? (C.O.No.1) [Knowledge]
   c) Classify the different methods of braking applied to the DC motor (C.O.No.2) [Knowledge]
   d) Type-A chopper has following specifications DC source voltage of 220V, total time period is 20 mSec and Turn off period is 5msec. Calculate output voltage and duty cycle? (C.O.No.2) [Knowledge]
   e) Compute the %slip of 3.2kW, 1440 rpm, 4 poles and 50 Hz three phase induction motor? (C.O.No.3) [Knowledge]
   f) A three phase, 50 Hz, 4 pole induction motor is controlled from a stator voltage regulator. The motor is running at a speed of 1000 rpm. Neglecting the core loss and stator impedance, the % efficiency of the motor will be. (C.O.No.3) [Knowledge]
   g) The maximum value of torque angle (δ) for a synchronous motor is _____ (C.O.No.4) [Knowledge]
   h) What is the value of pull out torque angle of a synchronous motor during braking region? (C.O.No.4) [Knowledge]
   i) What are the different types of drives used in cement industry? (C.O.No.5) [Knowledge]
   j) List out the different operating sections used in paper mills? (C.O.No.5) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each Question carries 07 marks. (4Qx7M=28M)

2. In a class room, the speed of the fan is controlled by a regulator called TRIAC, consider this as an example of an electric drive, identify the various parts of the electric drive and explain the each part in detail.

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

3. A 220V, 10.5A, 1300rpm DC shunt motor is used for wood cutting application and its armature resistance is 0.5Ω. It is required to carve the wood piece at 1000rpm at half the rated torque. The motor is controlled by single phase fully controlled rectifier with an AC source voltage of 230V, 50Hz. It is observed that the motor is running in reverse direction with the rated speed.

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

i) Identify the problem in the rectifier control circuit
ii) Mention the steps to be taken to rotate the motor in positive direction
iii) Compute the firing angle to run the motor at 1000rpm with half rated torque.

4. An induced draft (ID) fan is controlled by stator voltage control. The ID fan motor is having the following specifications 2.8KW, 400V, 50Hz,4 pole, 1370rpm, delta connected squirrel cage induction motor has following parameters referred to the stator: R_s=2Ω, R_r'=5Ω, X_s=X_r'=5Ω, X_m=80Ω,. When driving a fan load it runs at rated speed at rated voltage. Compute the values of motor terminal voltage, current & torque at 1200 rpm.

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

5. A 400 kW, 3-phase, 3.3 kV, 50 Hz, 0.85(lagging) power factor, 4 pole, star connected synchronous motor which is driving low speed compressors has the following parameters: X_s=15 Ω,R_s=0 Ω. Rated field current is 10A. Compute the armature current of the motor and the power factor at half rated torque and rated field current.

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

Part C [Problem Solving Questions]

Answer all the Questions. Each Question carries 08 marks. (4Qx8M=32M)

6. A drive has following equations for the motor and load torques:
$T = (1 - 2\omega_m)$ and $T_l = -3\sqrt{\omega_m}$ obtain the equilibrium points. Analyze results and determine their steady state stability.

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

7. A 230V, 960rpm and 200A separately excited motor has the armature resistance and inductance of 0.02Ω. The Motor is controlled both in motoring and regenerative braking modes by a chopper. The source has the DC voltage of 230V. Assuming continuous conduction
(a) Calculate duty ratio of chopper for motoring operation at rated torque and 350 rpm
(b) Calculate duty ratio of chopper for braking operation at rated torque and 350 rpm.

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

8. A 440 V, 50 Hz,970 rpm, 6 pole, star connected, slip ring induction motor has the following parameters: R_s=0.1Ω,R_r'=0.08Ω,X_s=0.3Ω, X_r'=0.4Ω,X_m can be neglected. Stator to rotor turns ratio is 2. The motor speed is controlled by static Krammer drive. The drive is designed for a speed range of 25% below synchronous speed. Maximum value of firing angle is 165^0.

   Compute i) Transformer turns ratio

   ii) Torque for a speed of 780 rpm and $\alpha = 140^0$

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

9. a) A 1492 kW ,unity power factor,3-phase ,star-connected ,2300 V, 50 Hz, synchronous motor has a synchronous reactance of 1.95 ohm/phase. Compute the maximum torque in N-m which this motor can deliver if it is supplied from a constant frequency source and if the field excitation is constant at the value which would result in unity power factor at rated load. Assume that the motor is of cylindrical rotor type. Neglect all losses.

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

   b) Classify the drives used in cement industry and explain them in detail.

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

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

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	CO 01 CO 02 CO 03 CO 04 CO 05	All modules	20 (4+4+4+4+4)			20
2	CO 01	Module-1		7		7
3	CO 02	Module-2		7		7
4	CO 03	Module-3		7		7
5	CO 04	Module-4		7		7
6	CO 01	Module-1			8	8
7	CO 02	Module-3			8	8
8	CO 03	Module-3			8	8
9	CO 04& CO 05	Module-4			(4+4)	8
	Total Marks		20	28	32	80

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 guidelines.

Faculty Signature:

Reviewer Commend:

Format of Answer Scheme

GAIN MORE KNOWLEDGE
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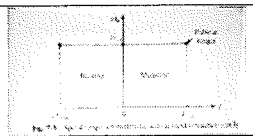
SCHOOL OF ENGINEERING

SOLUTION

Semester: Odd Sem. 2019-20
Course Code: EEE 304
Course Name: Electrical Drives
Program & Sem: B.Tech (EEE) & VII

Date: 20 December 2019
Time: 9.30 AM to 12.30 PM
Max Marks: 80
Weightage: 40%

Part A (10Q x 2M = 20Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1 a).	Fans,Compressors,ship-propellors	**2M**	**3Min**
1 b).	$T = T_l$	**2M**	**3Min**
1 c).	Dynamic, Regenerative and Plugging	**2M**	**3Min**
1 d).	1561rpm	**2M**	**3Min**
1 e).	0.066	**2M**	**3Min**
1 f).	172.5 N-m	**2M**	**3Min**
1 g).	90^0	**2M**	**3Min**
1 h).		**2M**	**3Min**
1 i).	Raw mill and cement mill drives, kiln drives, crusher drives, waste gas fan drives and compressor drives	**2M**	**3Min**
1 j).	Couch section, press section, dryer section, calendar and reel section	**2M**	**3Min**

Part B (4Q x 7M = 28 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
2	Driving the uphill (angle of inclination), Forward Motoring and Forward Braking, Speed- Torque conventions, Driving in reverse direction, Reverse Motoring and Reverse Braking, Speed- Torque conventions Draw four quadrants of Speed and Torque plane.	• Understanding the multi quadrant operation(2M) • Explanation of the speed-torque conventions while driving from Point A to Part B(Acceleration and Braking)/ Forward Motoring and Forward Braking (2M) • Explanation of the speed-torque conventions while driving from Point B to Part A(Reverese Acceleration and Reverse Braking)/ Reverse Motoring and Reverse Braking, Draw four quadrants of Speed and Torque plane (3M)	18Min
3	• The problem of the motor is, the firing angle of the rectifier is 1800. Since the firing angle is 1800, the motor is rotating in reverse direction. • Firing angle= 70.34^0	Problem Identification(2M) Computation of speed, back emf(3M) Computation of Firing angle(2M)	18Min
4	Synchronous speed= 1500rpm Slip= 0.0867 New slip= 0.2 Load Torque=36.9N-m V=253.2V Line current=17.89A	Synchronous speed= 1500rpm(1M) Slip= 0.0867 (1M) New slip=0.2 Load Torque=36.9N-m(2M) V=253.2V(2M) Line current=17.89A(1M)	18Min
5	Rated armature current= 109.3 Rated power factor = 0.8lag Excitation voltage= 1603 L-54.90 V New armature current= 52.75, angle -54.90 Power factor 0.34 lagging	Rated armature current= 109.3(2M) Rated power factor = 0.8lag Excitation voltage= 1603 L-54.90 V(2M) New armature current= 52.75, angle -54.90 (3M) Power factor 0.34 lagging	18Min

Part C (4Q x 8M = 32 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6	J=7.457 kg-m^2 T=7.93N-m P=830.35W	Computing the value of equivalent Moment of Inertia (2M) Computing the value of equivalent Torque (4M) Computing the value of Power (2M)	19Min
7	Back Emf at rated speed = 226V Back Emf at 600rpm=141.25V Duty cycle=0.83	Back Emf at rated speed = 226V (2M) Back Emf at 600rpm=141.25V(3M) Duty cycle=0.83(3M)	20 Min
8	Related formula for max slip Modified expression for slip after adding the external resistance Computation of Resistance to be inserted per phase	Related formula for max slip (2M) Modified expression for slip after adding the external resistance (2M) Computation of Resistance to be inserted per phase (4M)	19Min
9 a)	E= 1515.489 Volts P max=1032.014 kW/phase T max =3285 N-m Total Torque for three phases= 9855 N-m	E= 1515.489 Volts P max=1032.014 kW/phase(2M) T max =3285 N-m Total Torque for three phases= 9855 N-m(2M)	10Min
9 b)	Classifications and explanation of drive	Classifications and explanation of drive(4M)	10Min