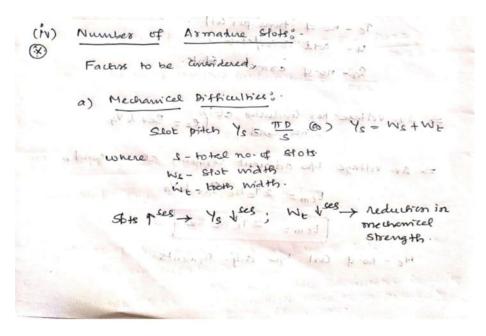
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TECHNOLOGY			USN _							CMR NATITIZET OF TROMOUSOY, BENGALOR BY	RIT MANUEL MANUEL
Internal Assesment Test II – Nov 2022 Set A											
Sub:		Electrical Machine Design Cod									
Date:	13/11/2022	Duration:	90 mins	Max Marks:	50	Sem:	V	Section :		A & B	
Note: Answer any five FULL Questions											
							OBE	D D			
Marks CO						СО	RB T				
1. Mention the factors to be considered during the choice of number of slots.							[10]	CO2	L1		
	2. Mention the factors to be considered during the choice of specific loadings.						[10]	CO2	L1		
3.	3. Mention the factors to be considered during the choice of number of poles						[10]	CO2	L1		
4 Explain the factors to be considered during the choice of air gap of a DC machine.						[10]	CO2	L2			
 5. Determine the main dimensions, number of poles and length of air gap of a 600KW, 500V, 900rpm generator. Assume average gap density as 0.6 Wb/m² and ampere conductors per meter as 35000. The ratio of pole arc to pole pitch is 0.75 and the efficiency is 91%. The following are the design constraints: i) Peripheral speed should not exceed 40m/s ii) Frequency of flux reversals should not exceed 50Hz. iii) Current per brush arm should not exceed 400A iv) Armature mmf per pole should not exceed 7500AT The MMF required for the air gap is 50 percent of armature MMF and gap contraction factor is 1.15. 						[10]	CO2	L4			
	What are the advamachine?	antages and	disadvar	ntages of nur	nber o	of poles	in a	ı DC	[10]	CO2	L1
	A 4 pole, 25hp, 500 pole faces are squ Bav=0.55 Wb/m ² , particulars of suitab	are and rate ac=17000	io of pol ac/m. D	e arc to pole	e pitch	is 0.6'	7. As	sume		CO2	L4

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1.Mention the factors to be considered during the choice of number of slots.



b) Cooling of Armature anductors: slots Ties _ lesser no. of conductors | slot are used. cooling is better. C) Flux Pulsabones. Flux pulsations, changes in the air gap fews due to Stothing - gives rise to eddy current lines in the pree faces Flet pares: -> produces marnete noise. Flux prisations are led by increasing no of armature => In actue deeren, No of slots pole as a should be intger with Slots pre equal to an integer plue 1. Step washing: d) Communitation: Sparkless Commutator + pulsations and oscillations of the flux under the interpole the flux under the . From Commutation point of View: by larger no of Slots and Emeiler number of conductors per stot ese better. => No of slots per pole should be accept 9.

(e) Cost :
Slots Uses => reduction in mentation Cost.

2.Mention the factors to be considered during the choice of specific loadings.

Choice of specific Electric loading (00) Ampere Conductive per metre (ac) + depends up on (i) Temp. nse (11) faced of machine (iii) Voltege. (iv) singe of machine (V) Armature rection (vi) Commutation. (i) Temp. nse: thisles value of a c -> armature heet dissipation also P => inpulation material aged in the m/c can intactand temp. 2018 choice of ac -> types of enclosure and arrive techniques of a mile-Sermi enclosed mite's

-horse value of a c"

(ii) Speed of machine:

m/c notates at third speed dissipation of theet is bettern.

first spect m/c - we of larg value ac.

(iii) Vottage:

ac value depends on no-of armatice anducers

HV m/c - thickens of impletion is large.

turs have for andulous

La lun value of ac

(1) Sinc of m/c:

lene sine m/c's -> more space required for accumodating the andulas.

(V) Armshre Reusin!

thish value if ac - army hie section will be series :

freed should be made shoper.

mms required for freed 1 - to present in Cost of the m/s 1. decrene of main flax.

(vi) Commutation:

Sp. Electric loading of crimature anduly

acta Zt

High value ac 1

ac & regulance vottage is a coil

d'inductance in the

High value of ac > wienerse the recolouse

delay in community is on

ac => 15000 to 50000 ac/m.

3.Mention the factors to be considered during the choice of number of poles

Selection of Number of poles: > factors affecting (i) Frequency (ii) Neight of im ports (iii) wt-of a (iv) Length of Commutatoo. (V) delour charges (vi) Heshover blu brushes (vii) Distration of field from. (i) Frequency: $f = \frac{np}{2}$ Frequency of these reversel of nor of pole of Inn me (li) Wt- of inn park: Ly a) yoke area b) Armetre are. e) Yoke area: Yoke shine Leunty -> same nt of im Yoke I if 1 in poly 4. Explain the factors to be considered during the choice of air gap of a DC machine.

```
Length of Air Grap:
    The length of air gap can be fixed by
ansidering the following:
(1) Armature Reaction:
=> To prevent excessive desiration of field from by the
     armature reaction
          Is field minf made large in Companison
              with the armature mmf.
 -> A machine designed with a long air gap requires
large field minf
    Thus the distorting effect of armature reaction
     can be reduced if the length of the air gep is
   made large of good in the
      Field many 1 ses => increase in singe & cost of the m/c
                     MME acquired for cargap
(11) Circulating currents:
      => If gap is small
          = (00)
   Sligat irregularity in air gep
     Pute face losses:
     lg is large -> prulsation lives in the pole
     fus decresses.
           lg is large - quiet noise.
(V) cooling: lg is large + better Ventillation.
```

(Vi) Mechanical (munices attorness.

Ig maintained large - to crosid field distribution)

> before advent of Commutating poles.

> By use of Commutating poles - brought down the values of airgap leights.

wierder to prevent field distribution from.

But some lg - wares unscarred mameric free pull

Causing roto to food with the status.

> g - maintain proper value.

- 5.Determine the main dimensions, number of poles and length of air gap of a 600KW, 500V, 900rpm generator. Assume average gap density as 0.6 Wb/m² and ampere conductors per meter as 35000. The ratio of pole arc to pole pitch is 0.75 and the efficiency is 91%. The following are the design constraints:
 - i. Peripheral speed should not exceed 40m/s
- ii. Frequency of flux reversals should not exceed 50Hz.
- iii. Current per brush arm should not exceed 400A
- iv. Armature mmf per pole should not exceed 7500AT
 - v. The MMF required for the air gap is 50 percent of armature MMF and gap contraction factor is 1.15.

The following are the design (ranstraints:

peripheral speed \$\frac{7}{40} \text{ m/s}\$

frequency of flux reversels \$\frac{7}{50} \text{ by TSDOM}\$

current per brush arm \$\frac{7}{400} \text{ f}\$

armature must per pule \$\frac{7}{7500} \text{ of armature must and gap is 50 percent of armature must and gap contraction factors is 1.15.

$$Pa = Co D^2 L n \text{ south in two}.$$

$$Co = TI^2 Ban ac \times 10^3 = TI^2 \times 0.6 \times 35000 \times 10^3 = 207.$$

Power developed by
$$Pa = \frac{boo}{0.91} = 6bok to.$$

$$n = \frac{900}{10} = 15 \text{ dps}.$$

$$b^{2}l = \frac{P_{0}}{con} = \frac{bb0}{207 \times 15} = b \cdot 212 b m^{3}$$

Number of price:

(i) - Frequency: , metal moderation of the - pol

Frequency of flux
$$g = f = \frac{pn}{2} H_2$$
.

If
$$p=8$$
, $d_1 = \frac{8 \times 15}{2} = 60 \text{ Hz}$.

poles (4,96, may be used, but we cannot use sportes since the frequency exceeds the mex. allowable limit of 50Hz.

(1) Current: per brish arms and my maries

Neglecting the freed current,

$$K = \frac{P}{V}$$
 $I_4 = \frac{600 \times 1000}{500} = 1200 A$

current per brush arm Iq = 2 Iq

With p=b, Ib = 2x1200 = 4004.

this means that 4 poles carried be used for this madeine.

.. number of poles = b.

dength of Air gap: $Bg = \frac{0.6}{0.75} = 0.8 \text{ wb/m}^2$ MMF rep. at airgup ATg = 8,00,000 x 0.8 x1.15 lg = 7,36,000 lg $\rightarrow 0$ Also air gep mmf per pole ATg = 0.5 ATq = 0.5 x 7350 = 3675 AT $\rightarrow \infty$.

Einsting $\mathfrak{O}q$ \mathfrak{O} , $l_q = \frac{3675}{736000} \approx 5 \text{ mm}$.

Results:

(1) Main Dimensions

D= 0.8 m = Ed EDE-0

Y= 0.33m = 0

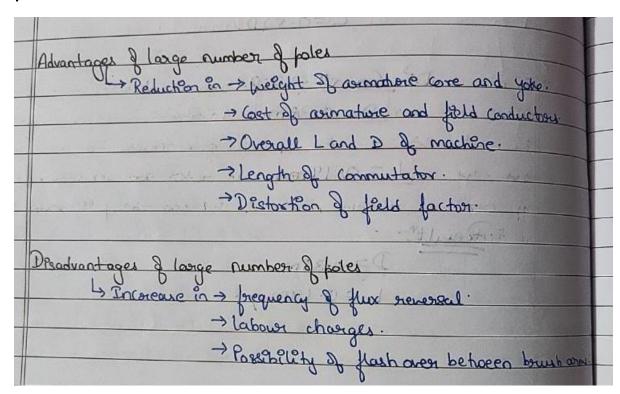
(11) wo of poces | b= p: (11518-7=

(mi) lg = 5 mm standard mand

phesal speed

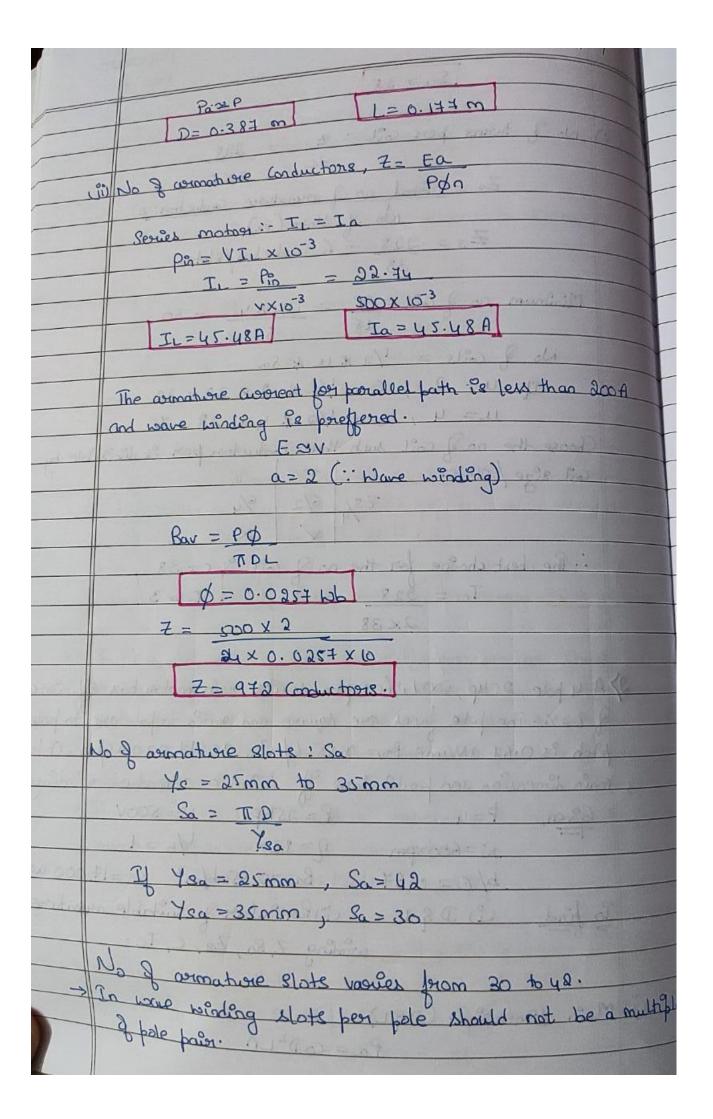
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6. What are the advantages and disadvantages of number of poles in a DC machine?

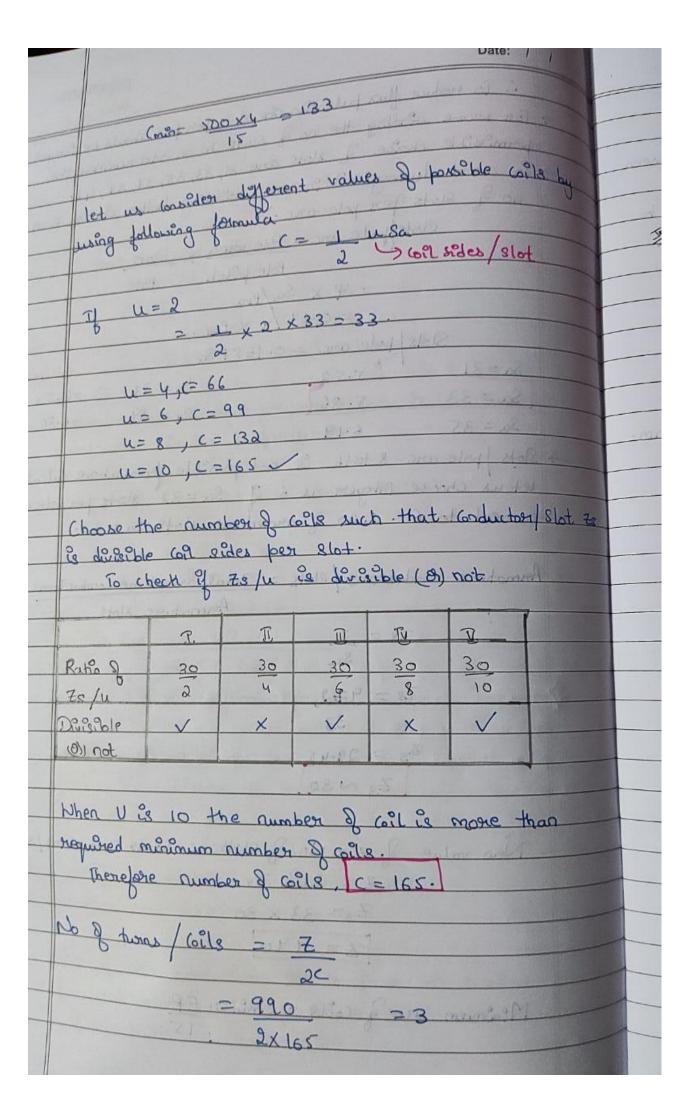


7.A 4 pole, 25hp, 500V, 600 rpm series crane motor has an efficiency of 82%. The pole faces are square and ratio of pole arc to pole pitch is 0.67. Assume Bav=0.55 Wb/m², ac=17000 ac/m. Determine the main dimensions and particulars of suitable armature winding.

Giren,	P=4 P=25hp. V=500V
	N=600xpm 7=82% 4b=1
	b/2 = 0.67 Bar = 0.55 bb/m2 ac = 17,000 ac/m.
To find	(i) D& L (ii) Particular & suitable armature
0	winding Z, Sa, Zs, C, Tc.
1200	de more where state grant property to all
i) Main din	engions (D&L)
	$Pa = GoD^2Ln$



	paperism						
	Date: / /						
· To greduce they bulgate .							
To reduce the pulsation the slots per pole should be integer the							
permissible choice I all a one number The							
> 10 avoid dummy (09 0							
no of slots per pale arc.							
Clots bale and - Q1							
Polo 1911							
Pole pitch Pole							
= 4 x Sa/Pea = 0.67 /4 x Pea.							
Slots pole anc = 0.1657 & slots/poleans							
Sa = 31 5.52 Sa = 37	elots/pole arc						
$S_{0} = 33$ $S_{0} = 34$ $S_{0} = 34$ $S_{0} = 39$							
Sa = 35 6.19	26.86						
Slots pole arc 8 to 16 is not possible from above calculation let us chance integer as 6 if Sa = 32 slots per pole arc							
nearest to 6. i. no of armature slots sa	ots per pole arc						
· fall with a Real and	= 92.						
Asimature Conductoris / Slots = Total asimature	2 1 1						
A							
78 = 7	1943						
3a	0 5 5						
	d on the						
15 - 17d	18,08						
33 ×	Maria Salara						
Zs = 29.45	July 1899 F						
Z ₈ ~ 30							
Just mayor & Box of madown ash on & C	S and the second						
New value of 7 = No. g. 86ts x 8dots	Conductores/Slots						
7 - Sax Ze	49.77						
$7 = 33 \times 30$							
7=990							
The state of the s							
Man Question FP							
Menimum no of coile = Cinin = EP							
7-120							



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	Date: / /
No & tomes (oils = 3)	
Result & L = 0.177m = = 990	and the
D=0.387m	2 (11) 21
 13 13 10 hospe Investigland not always 1 12931	100 to