Roll No: | | | | | | | | | | | | | |

BTECH
(SEM IV) THEORY EXAMINATION 2021-22
ELECTRICAL MACHINES & CONTROLS

Time: 3 Hours ***Total Marks: 70***

Notes:

- *Attempt all Sections and assume any missing data.*
- *Appropriate marks are allotted to each question, answer accordingly.*

SECTION-A	Attempt **All** of the following Questions in brief	Marks**(7*2=14)**
Q1(a)	Why are copper losses negligible during open circuit test on transformer?	
Q1(b)	What do you mean by 3-phase transformer groups?	
Q1(c)	Why starters are needed in DC motors? Name the starters used.	
Q1(d)	Explain how feedback affects Overall gain of the system?	
Q1(e)	Draw the polar plot for $G(s)H(s) = \frac{K}{s}$	
Q1(f)	Classify the following as open or closed loop system with valid reasons (i) An electrical On-Off switch, (ii) Room air-conditioner.	
Q1(g)	What is the need of PID controller?	

SECTION-B	Attempt **ANY THREE** of the following Questions	Marks**(3*7=21)**
Q2(a)	Explain with necessary diagrams how transformers can be used to convert a 3-phase supply to a 2-phase supply. If load is balanced on one side, show that it will be balanced on other side.	
Q2(b)	Write Short Notes on the following: i) Two phase servomotor and its application ii) Speed Control of 3-phase induction motor	
Q2(c)	Determine whether the following signal is periodic or not, is so find it's period $x(t) = \cos t + \sin \sqrt{2}\, t$ $y(t) = 3 \sin t + 5 \cos\left(\frac{4}{3} t\right)$	
Q2(d)	The open loop transfer function of a unity feedback system is given by $G(s) = \frac{4}{s(s+1)(s+5)}$ Sketch the polar plot and determine the gain margin and phase margin.	
Q2(e)	Using Bode Plot Comment on the stability of the following unity feedback open loop transfer function $G(s) = \frac{50}{s(s+1)(s+2)}$	

SECTION-C	Attempt **ANY ONE** of the following Questions	Marks **(1*7=7)**
Q3(a)	What is meant by the terms transformed volt-amperes and conducted volt-amperes in an autotransformer? Show that two windings connected as an autotransformer will have greater VA rating than when connected as a 2-winding transformer.	
Q3(b)	A 200KVA, 2000/440V, 50Hz 1-phase transformer gave the following results: OC test(hv) 2 kV 1.75 kW 1.8 A SC test(lv) 13 V 1 kW 300A Find (a) parameters of equivalent circuit as referred to h.v. side, (b) regulation and efficiency at full-load, 0.8 p.f. lagging.	

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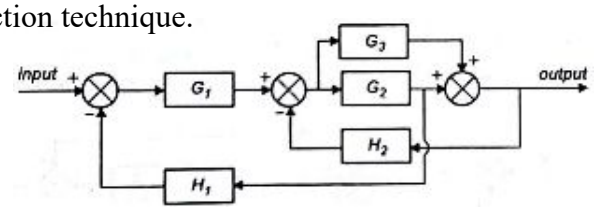
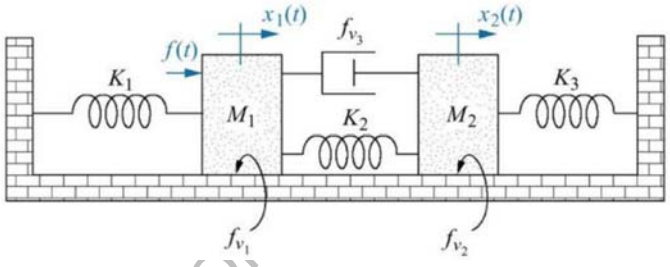
SECTION-C	Attempt **ANY ONE** of the following Questions	Marks **(1*7=7)**
Q4(a)	Describe briefly the effect of varying excitation upon armature current and power factor of a synchronous motor when input power to the motor is maintained constant.	
Q4(b)	A 3-phase 1500KVA, 6600V, star connected alternator having an armature resistance of 0.093 ohm per phase and a synchronous reactance of 8.5 ohm per phase. Find the voltage regulation at full load 0.8 p.f. lagging and 0.6 p.f. leading.	

SECTION-C	Attempt **ANY ONE** of the following Questions	Marks **(1*7=7)**
Q5(a)	Determine the overall transfer function of the following block diagram by using block diagram reduction technique. 	
Q5(b)	Find the transfer function $X_2(s)/ F(s)$ for the Mechanical translation system shown in figure. 	

SECTION-C	Attempt **ANY ONE** of the following Questions	Marks **(1*7=7)**
Q6(a)	The response of a system subjected to a unit step input is $C(t)=1+ 0.2e^{-60t} -1.2 e^{-10t}$ Obtain the expression for the closed loop transfer function. Also determine the undamped natural frequency and damping ratio of the system.	
Q6(b)	Using Routh's stability Criteria, determine the range of K for open loop transfer function $G(s)H(s) = \frac{K}{s(s+1)(1+2s)}$	

SECTION-C	Attempt **ANY ONE** of the following Questions	Marks **(1*7=7)**
Q7(a)	Sketch the root loci for the open loop transfer function given below (the gain K is assumed is to be positive) and determine whether a system is stable or not: $G(s)H(s) = \frac{K}{s(s+1)(s^2+4s+13)}$	
Q7(b)	Give frequency domain specifications. Determine the expression for resonant peak and resonant frequency for a second order system.	