Ex/IEBE/PE/T/215/2019

B.E Instrumentation & Electronics Engineering 2nd Year 1st Semester Examination – 2019

Subject: Electrical Machines- I

Time: Three hours **Full Marks: 100**

Module	Each module must be answered as per given instruction	Marks
[1]	**Answer *any ten* from this module**	**[10×2]**
(a)	State basic deference between lap & wave winding in a d.c machine.	
(b)	Classify d.c motor. Which one is applicable for high starting torque?	
(c)	Briefly state the condition of voltage build up of a d.c shunt generator.	
(d)	State the principle of Faraday's law of electro-magnetic induction.	
(e)	State the principle of Lenz's law.	
(f)	Define back e.m.f in d.c motor.	
(g)	What do you mean by commutation?	
(h)	Classify d.c series generator. Mention their applications.	
(i)	State the basic difference between core & shell type transformer.	
(j)	Define transformation ratio.	
(k)	Define voltage regulation of transformer.	
(l)	State basic advantage of Sumpner or back to back test of transformer.	
(m)	What is the condition of maximum efficiency of transformer?	
(n)	Which type 3ph transformer connection we have to bother about neutral point shifting problem?	
(o)	Why transformer core is laminated?	
[2]	**Answer *any one* from this module**	**[1×10]**
(a)	Briefly explain the torque-speed characteristic of d.c series & shunt motor. Comment on suitable motor for constant speed operation.	[4+4+2]
(b)	Briefly state the necessity of starter in d.c motor. Briefly explain necessary speed control technique for above & below rated speed for a d.c motor.	[2+4+4]
[3]	**Answer *any two* from this module**	**[2×10]**
(a)	Derive the equivalent circuit of a single phase transformer with complete vector diagram.	[8+2]
(b)	Derive the equation of voltage regulation for a single phase transformer under lagging power factor load with a suitable vector diagram.	[8+2]
(c)	Showing the suitable connection diagram & vector diagram of respective 3-phase voltage phasors, briefly state primary & secondary side voltage & current equation for the following 3-phase transformer connection : i) $Y\text{-}y_0$, ii) $D\text{-}y_1$	[4+4]
[4]	***Answer any two* from this module**	**[2×10]**
a)	Briefly explain the suitable tests are carried out for open circuit characteristics & external characteristics of a d.c generator drawing necessary connection diagram & characteristics curves.	[3+3+2+2]
b)	Derive the condition of maximum efficiency of a d.c generator & obtain the load current for that condition.	[8+2]
(c)	Briefly explain back to back test of single phase transformer with a neat connection diagram.	[8+2]
[5]	**Answer *any three* from this module**	**[3×10]**
(a)	A shunt generator has a full load current 200A at 230V. The stray losses are 700 W & the shunt field coil resistance is 115 Ω. It has full load efficiency of 90%. Find the armature resistance & also the load current for maximum efficiency.	[10]
(b)	A d.c series motor takes 35 A at 230 V & runs at 900 r.p.m. If the armature & field resistance are 0.25 Ω & 0.15 Ω respectively. The iron & friction losses are 0.8 kW. Find the torque developed in the armature & also the output power of the motor.	[10]
(c)	A 150 kVA, 2-winding transformer has an iron loss of 1.5 kW & the cupper loss on normal output current of 2 kW. Calculate the kVA loading at which the efficiency is maximum. Also find its efficiency at this loading at unity p.f & at 0.7 p.f leading.	[10]
(d)	The connected instrument readings obtained from open & short-circuit tests on 15-kVA, 440/110V, 50Hz transformer are: O.C test:-110V, 4A, 90W, S.C test:- 10V, 25 A, 150W. Compute the equivalent circuit constants (approx.). Also find the full load efficiency & voltage regulation at 0.7 lagging p.f load.	[10]