SET -2 **APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2017

Course Code: EE 216
Course Name: Electrical Engineering

Part A
Answer any TWO full questions (2 X 15=30 marks)

1 **a)** Working principle of transformer- Mutual induction
Explanation – 3 marks
Diagram -2marks

b) Primary induced emf E_1= 500V
Frequency=50Hz, N_1= 400
Net cross sectional area of core A= 0.006cm^2
Maximum value of flux $\varphi_{max}= E_1/ 4.44 fN_1$ (1 Mark)
= 500/400X50X400
= 0.00563Wb (1 Mark)

i) Peak flux density in the core $B_{max}= \varphi_{max}/A$= 0.9384 T (1.5 Marks)

ii) Voltage induced in the secondary winding $E_2= E_1 N_2/N_1$ = 1250V (1.5 Marks)

c) Draw approximate and exact equivalent circuit of transformer
Equivalent circuit - 3 marks
Explanation – 2 marks

2 **a)** Emf equation of dc generator
Generated emf$E_g= \varphi ZNP/60A$
Φ- fluxperpole
Z- total no. of conductors
N-rotational speed of armature
P- no. of poles
A-no. of parallel path A=2 for wave wound, A=P for lap wound
Derivation – 5 marks

b) Generated emf$E_g= \varphi ZNP/60A$ (2 Marks)

i) When machine is lap connected A=P=6

E_g = 0.05X720X1000X6/60X6
= 600V (3 Marks)

c) Interpoles are provided in midway between main poles for
a) Neutralizing armature reaction
b) Spark less commutation
Explanation- 5marks

3

a) V_1=250V, N_1=120, N_2=800
Secondary voltage $V_2= V_1 N_2/N_1$= 250X800/120=1667V
Emf per turn= V_2/N_1= 250/120=2.08V
Secondary voltage V_2= 2.08X800= 1667V
(Equation 2.5 Marks, Answer 2.5 Marks)

b) The effect of magnetic field set up by the armature current on distribution of flux under the main poles of a dc machine is known as armature reaction.

Cross magnetizing effects and demagnetizing effects
Explanation- 5 makrs

c) Conditions for dc shunt generators in parallel
a) Same polarity
b) Equal terminal voltage
Explanation- 5marks

Part B

Answer any TWO full questions (2 X 15=30 marks)

4 **a)**
a) torque armature current characteristic- electrical characteristics
b) Speed- armature current characteristic- speed characteristics
c)speed- torque current characteristic- mechanical characteristics
d) Performance characteristics
(Naming the important charecteristics of DC Motor 2 Marks,
Characteristics of DC Series motor 3 Marks)

b) Line current at half load =60/2=30A (1 Mark)
$I_a = I_l - I_{sh}$= 30-2=28 A (1 mark)
E_b half load = V- I_aR_a= =120- 28X0.2= 114.4V(1 Mark)
E_bFull load = 108.4 V (1 Mark)
Speed of motor at half full load N= N_fX E_b half load/ E_b full load= 1899.63rpm (1 Mark)

c) Power flow diagram of a DC motor
Diagram- 5 marks

5 **a)** Write ay five advantages of stationary armature and rotating field in an alternator.
a) Easier to insulate for very high voltage
b) The load circuit can be connected directly with the fixed terminals of the stator
c) Prevent deformation developed by the mechanical stresses
d) The armature winding is cooled more readily
e) Only two slip rings are are required for the supply of direct current to therotor
Any five advantages – 5 marks

b) Distribution factor = Emf induced in distributed winding / EMF induced if the winding would have been concentrated
$K_d = \frac{\sin m\beta/2}{m\sin\beta/2}$
Proof – 5 marks

c) Draw the equivalent circuit of three phase induction motor- 3 marks
Explanation- 2 marks

6 **a)** Three point starter
Diagram- 4 marks
Explanation-4 marks

b) Starting methods
a) From DC source
b) AC motor
c) Damper grids in the pole faces
Explanation – 7 marks

Part C

Answer any TWO full questions (2 X 20=40 marks)

7 **a)** Explain the production of pulsating magnetic field in single phase induction motor- 5 marks
Double revolving field theory – with diagram and explanation-5 marks

b) N_s= 120f/P=1000 rpm
i) Slip= $\frac{N_s - N}{N}$=0.025 (1 mark)

Stator output power= 40- 1=39 kW
Power input to rotor, P_2= 39 kW

ii) Rotor cu loss, P_{cu}= sP_2= 0.975 kW
Mechanical power developed, Pmech= P_2- Pcu= 38.025kW (3mark)
Motor output= Pmech- friction and windage losses= 36.025kW (2marks)

iii) BHP= 36.025/0.7355= 49 (2 marks)

iv) Motor efficiency=(36.025/40)X100= 90.0625% (2 marks)

8 **a)** Construction of PMMC instrument- 3 marks
Diagram- 3 marks
Working-4 marks

b) Electrodynamometer type wattmeter
Construction- 6marks
Diagram-4 marks

9 **a)** AC servo motors are best suited for low power applications , ac motors are always preferred to dc motors

a) Squirrel cage rotors are simple and rugged in construction compared to the complex armature windings found on dc machines
b) Ac servo motors have no brush to commutator contacts
c) There is no insulation around the armature conductors as there is on a dc motor
d) Armature has no complicated insulated windings
Any four points- 4 marks

b) Copper loss in rotor and stator, Iron loss, friction and windage loss
Mention the parts – 4 marks

c) Power measurement using two wattmeter method
Diagram-3 marks
Explanation- 3 marks
Equations-2 marks

d) Principle of operation of DC potentiometer
Diagram-2 marks
Explanation-2 marks

****