Marks Scored:

KATHMANDUUNIVERSITY
End Semester Examination [C]
June, 2018

Level : B.E.
Year : III

Course : EPEG 302
Semester: I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No. :

Date : JUN 15 2018

SECTION "A"
[20 Q × 0.5=10 marks]

Choose the most appropriate answer.

1. The principle of operation of a three phase induction motor is similar to that of a
   a. Synchronous motor
   b. Repulsion start induction motor
   c. Transformer with a shorted secondary
   d. Capacitor start induction run motor

2. A 3 phase 4 pole, 50 Hz induction motor runs at speed of 1440 rpm. The rotating field produced by the stator rotates at speed of ..... rpm with respect to the rotor
   a. 1500 b. 60 c. 1440 d. Zero

3. The efficiency of a three phase induction motor is approximately proportional to
   a. (1-s)
   b. Rotor speed, N
   c. s
   d. Synchronous speed, Ns

4. Pull out torque of a squirrel cage induction motor occurs at that value of slip where rotor power factor equals
   a. Unity b. 0.866 c. 0.707 d. 0.5.

5. A squirrel cage induction motor runs at constant speed only so long as
   a. Torque developed by it remains constant
   b. Its supply voltage remains constant
   c. Its torque exactly equals the mechanical load
   d. Stator flux remains constant

6. The chemical used in breather of transformer should have the quality of
   a. Ionizing air
   b. Cleansing the transformer oil
   c. Absorbing moisture
   d. Cooling the transformer oil

7. The function of a radiator in transformer is
   a. To protect against internal fault.
   b. Expand and contrast the transformer oil subjected to temperature variation.
   c. To reduce copper as well as core losses.
   d. To cool the transformer oil.

8. The starting winding of a single phase induction motor is placed in the
   a. Rotor b. Stator c. Armature d.Field

9. A single phase induction motor
   a. Is self-starting
   b. Is not self-starting
   c. Require only one winding
   d. Can rotate in one direction only

10. After the starting winding of a single phase induction motor is disconnected from the supply, it continues to run on
    a. Rotor winding.
    b. Field winding
    c. Running winding
    d. Compensating winding

11. The capacitor in a capacitor start induction run ac motor is connected in series with
    a. Starting winding
    b. Running winding.
    c. Squirrel cage winding
    d. Compensating winding

12. The crawling of an induction motor is caused by
    a. High loads
    b. Low voltage supply
    c. Improper design of machine
    d. Harmonics developed in motor

13. In an induction motor slip, s equals
    a. $\frac{Ns-N}{Ns}$.
    b. $\frac{Ns-N}{N}$
    c. $\frac{N-Ns}{Ns}$
    d. $\frac{N-Ns}{N}$
    where, Ns = synchronous speed and N= rotor speed.

14. The condition for maximum torque under running condition at supply frequency, if R_2 = rotor resistance, X_2 = rotor reactance and s = slip will be when
    a. $R_2 * X_2 = 1$
    b. $s * R_2 = X_2$
    c. $R_2 = s * X_2$
    d. $R_2 = s^2 * X_2$

15. The voltage regulation of an alternator having 0.75 leading power factor load, no load emf of 24000 V and rated terminal voltage of 3000 V is
    a. 20 percent
    b. -20 percent
    c. 150 percent
    d. -26.7 percent

16. With a load power factor of unity, the effect of armature reaction on the main field flux of an alternator is
    a. Distortional
    b. Magnetizing
    c. Demagnetizing
    d. Nominal

17. The oscillation in a synchronous motor can be damped out by
    a. Maintaining constant excitation
    b. Running the motor on leading power factors
    c. Providing damper bars in the rotor pole faces
    d. Oscillation cannot be damped out

18. An alternator is connected to an infinite busbars. Its excitation is increased while its driving power remains constant. This will result in
    a. Less lagging power factor
    b. More lagging power factor
    c. Terminal voltage drop
    d. Terminal voltage increase

19. It is never advisable to connect a stationary alternator to live bus bar because
    a. It is likely to run as synchronous motor
    b. Will get short circuited
    c. Will decrease bus bar voltage though momentarily
    d. Will disturb generated emf of other alternators connected in parallel

20. The frequency of voltage generated by an alternator having 4 poles and rotating at 1800 rpm is ..... Hertz
    a. 60
    b. 50
    c. 120
    d. 30

KATHMANDU UNIVERSITY
End Semester Examination [C]
June, 2018

JUN 15 2018

Level	: B.E.	Course	: EPEG 302
Year	: III	Semester	: I
Time	: 2hrs. 30 mins.	F.M.	: 40

SECTION "B"
[5 Q × 8 = 40 marks]

*Attempt **ANY FIVE** questions. Assume any suitable data if required.*

1.
   a. Derive the expression for power developed by a salient pole synchronous generator and show that the total power is combination of power due to field excitation and saliency. [4]
   b. A 200 kVA, 480 V, 50 Hz, Y-connected synchronous generator with a rated field current of 5 A was tested and the following data were obtained:
   Open circuit voltage, $V_{T,OC}$ = 540 V at the rated field current, I_F.
   Short circuit current, $I_{L,SC}$ = 300 A at the rated field current, I_F.
   When a DC voltage of 10 V was applied to two of the terminals, a current of 25 A was measured.Find the generator's model at the rated conditions (i.e., the armature resistance and the approximate synchronous reactance). [2+2=4]

2.
   a. Explain about the V-curve of an alternator [4]
   b. A 480 V, 50Hz Y connected, six pole synchronous generator has a per phase synchronous reactance of 1Ω. Its full load armature current is 60A at 0.8 power factor lagging. The generator has friction and wind age loss of 1.5 kW and core losses of 1 kW at 60 Hz at full load. Since the armature resistance is being ignored, assume that the I^2R losses are negligible. The field current has been adjusted so that the terminal voltage is 480V at no load.
      i. What is the speed of rotation of this generator?
      ii. Determine the efficiency of the generator when it is operating at the rated current and 0.8 pf lagging? [2+2=4]

3.
   a. The exciting current was found to be 3A when measure on the LV side of a 20 kVA, 2000/200 V transformer.Its equivalent impedance referred to the HV side is (8.2+j0.2)Ω. Choose the transformer rating as base.
      i. Find the exciting current in per unit on the LV as well as HV side.
      ii. Express the equivalent impedance in per unit on the LV as well as HV side. 2+2=4]
   b. Two transformers are connected in parallel. The load 150 kVA at 0.9 p.f. is to be shared by them. Determine how the load will be shared when transformer 1 has percentage resistance and percentage reactance 1.2% and 5.2% respectively and the transformer 2 has percentage resistance and percentage reactance 1.6% and 4.2% respectively. [4]

4.
   a. Describe about various parts of a power transformer being employed in switchyards. [4]
   b. A synchronous motor referred to as synchronous condenser when operated on no load can be used for improving power factor. Explain with the aid of a V curve the method of power factor correction. [4]

5.

a. "The condition for maximum starting torque of a three phase induction motor is obtained when rotor resistance per phase equals rotor reactance at standstill per phase". Derive it. [2]

b. A 460-V, 25-hp, 60 Hz, four-pole, Y-connected induction motor has the following impedances in ohms per phase referred to the stator circuit:

$$R_1 = 0.641\Omega R_2 = 0.332\Omega$$

$$X_1 = 1.106\ \Omega X_2 = 0.464\ \Omega X_M = 26.3\ \Omega$$

The total rotational losses are 1100 W and are assumed to be constant. The core loss is lumped in with the rotational losses. For a rotor slip of 2.2 percent at the rated voltage and rated frequency, find the motor's speed, stator current and efficiency. [1+1+2=4]

c. Explain about the methods of increasing starting torque of squirrel cage induction motors. [2]

6.

a. A 3 MVA, 6 pole alternator runs at 1000 r.p.m in parallel with other machines on 3.3 kV busbars. The synchronous reactance is 15 percent. Calculate, synchronizing power per mechanical degree of rotor displacement at no load and corresponding synchronizing torque [1+1+2=4]

b. A three phase step down transformer takes 10A when connected to 6600V mains. The turn ratio per phase is 10. Neglecting losses, find the secondary line voltage, line current and output if the transformer windings are connected

i. Star/delta connected.
ii. Delta/star connected

[2+2=4]

Marks Scored:

KATHMANDUUNIVERSITY
End Semester Examination [C]
June, 2018

Level : B.E.
Year : III
Course : COEG 304
Semester: I

Exam Roll No. :
Time: 30 mins.
F. M. : 20

Registration No.:
Date JUN 14 2018

SECTION "A"
[20 Q.×1=20 marks]

Choose the most appropriate option.

1. The impulse response of an initally relaxed linear system is $e^{-2t}u(t)$. To produce a response of $te^{-2t}u(t)$, the input must be equal to
   a) $e^{-t}u(t)$ b) $e^{-2t}u(t)$ c) $2e^{-t}u(t)$ d) $(½)e^{-2t}u(t)$

2. .....will have the effect of eliminating the steady-state error,but may make the transient response worse.
   a) K_{PID} b) K_I c) K_D d) K_P

3. Consider the closed loop system given by $\frac{C(S)}{R(S)}=\frac{\omega_n^2}{S^2+2\xi\omega_n S+\omega_n^2}$.Determine the value of ξ so that the system responds to a step input with approximately 5% overshoot.
   a) 0.589 b) 0.689 c) 1.48 d) 0.703

4. A negative feedback closed loop system is supplied to an input of 5 volt. The system has a forward gain of 1 and a feedback gain of 1.What is the output voltage?
   a)1.98 V b)1.5V c) 2.8 V d) 2.5 V

5. The open loop transfer function of a unity feedback control system is $G(S)=\frac{K}{S(S+10)}$. Determine the value of gain factor k for critical damping.
   a) 11 b) 25 c) 22 d) 16

6. The output of a system 'y' is given by equation: y = ax + b, where x is input and a, b are constants. The system exhibits:
   a) linear behaviour
   b) non-linear behavior as it does not satisfy the property of superposition
   c) non-linear behavior as it does not satisfy the property of homogeneity
   d) non-linear behavior as it does not satisfy the property of both homogeneity and superposition

7. Determine the resistance of the RTD at 50°C if the resistance of the RTD at 0°C is 2.8Ω and temperature coefficient of material is $0.003°C^{-1}$.
   a) 1.62 Ω b) 3.22 Ω c) 2.89 Ω d) 5.33 Ω

8. For the closed loop control system,if the values of ω_n is 3.53 damping ratio is 0.424 then determine the time period of the first overshoot.
   a)1.91 s b) 1.35 s c) 1.96 s d) 2.06 s

9. A first order system has a time constant of 20s.It is subjected to a step input.The settling time of the output is assumed to be the time it reaches 95% of the final steady state value. The settling time of the system is:
a) 10 s b) 60 s c) 50 s d) infinity

10. A 2 gm mass is suspended from a simple spring.The deflection caused is 5 mm.The natural frequency of the system is:
a) 7Hz b) 22 Hz c) 2.2 Hz d)2 Hz

11. A wheat stone bridge has the following arm values: R_1=1.5 kΩ, R_2=500 Ω, R_3 is unknown, R_4=2kΩ.What values of R_3 brings the bridge into null condition?
a) 666.66 Ω b) 6 kΩ c) 375 Ω d) 4.5 kΩ

12. A closed loop control system has the characteristic equation,$S^4 + 2S^3 + 2S^2 + 3S + 6 = 0$. The number of roots on right half plane are
a) 2 b) 4 c) 3 d) 1

13. .....have lower accuracy and hence they cannot be used for .....
a) thermistor, sensitive work b) thermocouples, precision work
c) RTD, sensitive work d) thermistor, precision work

14. In a second order system,the damping factor is 0.65 and the natural frequency is 4Hz. If the spring constant is halved, the new values of damping factor and natural frequency are:
a) 0.92,2.83 Hz b) 0.46,5.66 Hz c) 0.92,5.66 Hz d) 0.46,2.83 Hz

15. If the digital input is $(101)_2$ then find the analog output voltage using R-2R ladder if V_{ref}=5 V and R_{in}=Rf=15 kΩ.
a) -3.125V b) -3.065V c) 3.135V d) 3.5V

16. AC to DC converter converts .....AC voltage to a ..... DC voltage.
a) variable, fixed b) fixed, variable c) low, high d) high, low

17. Determine the value of time constant for the decaying envelop of the control system whose transfer function is $\frac{C(S)}{R(S)} = \frac{180}{S^2+19.6S+196}$.
a) 0.106 s b) 0.29 s c) 0.15 s d) 0.102 s

18. The rise time and peak time of a second order underdamped system are 0.8s and 1s respectively.Find the value of damping factor.
a) 0.809 b) 0.89 c) 0.806 d) 0.86

19. In a second order system,the steady state error is 0.02.If both viscous friction constant and spring constant are doubled,the steady state error will be:
a) 0.01 b) 0.04 c) 0.07 d) 0.02

20. The resistance wire strain gauge with a gauge factor of 2 is bonded to a steel structural member subjected to a stress of 100 MN/m^2.The modulus of elasticity of steel200GN/m^2. Calculate the percentage change in the gauge resistance due to the applied stress.
a) 0.45% b) 0.23% c) 0.1% d) 0.8%