Total No. of Questions – [5] Total No. of Printed Pages: 5

G.R. No.	

U118-1041B (BE-FF)

DEC 2018 / BACKLOG

F. Y. B. TECH. (COMMON) (SEMESTER - I)

COURSE NAME: BASIC ELECTRICAL ENGG.

COURSE CODE: 10174B

(2017 PATTERN)

Time: [**2 Hours**] [Max. Marks: **50**]

(*) Instructions to candidates:

1) **Answer Q.1 OR Q.2, Q.3 OR Q.4 and Q.5**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data where ever required**

MODEL ANSWERS AND SCHEME OF MARKING

Q.1) a) $\Phi_T = 0.02$ Wb, $Z = 600$

$N = 1000$ rpm, $P = 4$; $A = P = 4$ for lap winding $A = 2$ for wave winding

Now, $E_g = \Phi ZNP/60A$

i) For lap winding: - $E_g =$ **200 V** **3M**

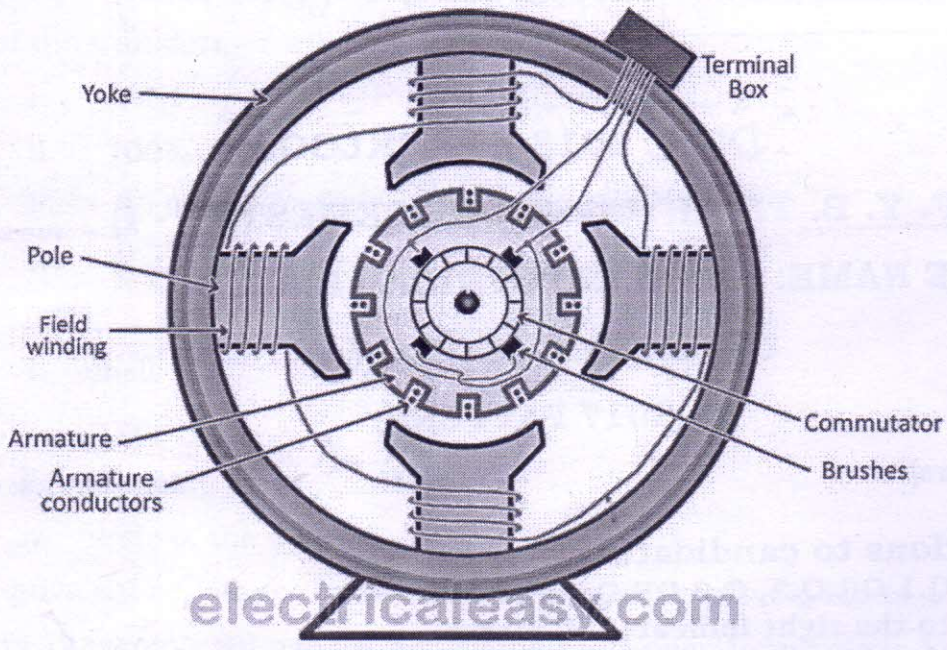
ii) For wave winding: - $E_g =$ **400 V** **3M**

b) Applications of dc motors

DC shunt motor (**Any two**): - Lathe machine, fans, pumps, compressors, blowers etc. **2M**

DC series motor (**Any two**): - Traction, Conveyors, lifts, cranes, hoist etc. **2M**

c) Neat diagram with correct labeling **6M**



OR

Q.2) a) Torque developed by dc motor with usual notations (steps) **4M**

The turning or twisting moment of a force about an axis is called torque. It is measured by the product of the force and the radius at which this force acts.

Consider a pulley of radius meter acted upon by a circumferential force of Newton which causes it to rotate at rpm.

Then torque $T = F \times r$ newton-metre(N-m

Work done by this force in one revolution

=Force× distance

$= F \times 2\pi r$ joule

Power developed $= F \times 2\pi r \times N$ joule/second or watt $= (F \times r) \times 2\pi N$ watt

Now, $2\pi N$ = angular velocity ω in radian per second and $F \times r$ =torque T

Hence, power developed $= T \times \omega$ watt or $P = T\omega$ watt

Moreover, if N is in rpm, then

$\omega = 2\pi N / 60$ rad/s

Hence, $P = \frac{2\pi N}{60} \times T$ or $P = \frac{2\pi}{60} NT = \frac{NT}{9.55}$

Armature torque of a motor

Let T_a be the torque developed by the armature of a motor running at N rps. If T_a is in N-m, then

power developed $= T_a \times 2\pi N$ watt

We also know that electrical power converted into mechanical power in the armature $= E_b I_a$ watt.

Comparing above equations, we get $T_a \times 2\pi N = E_b I_a$

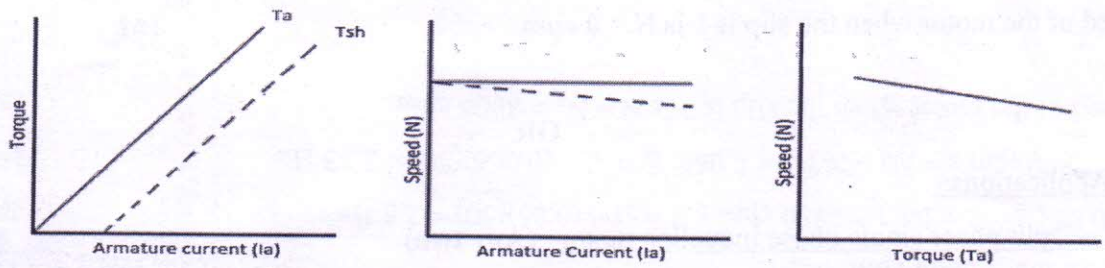
After simplification, if N in rps, $T_a = \dfrac{E_b I_a}{2\pi N}$

If N is in rpm, then $T_a = 9.55 \dfrac{E_b I_a}{N}$ N-m

Also, $T_a = 0.159 \phi Z I_a \times (P/A)$ N-m

2M

b) Torque-armature current, speed-armature current and speed-torque characteristics of a dc shunt motor. **2M each**



c) Field current, $I_f = 220/110 = 2$ A **1M**

Supply current, $I = I_a + I_f$ hence,

Armature current, $I_a = 82 - 2 =$ **80 A** **1M**

Back e.m.f., $E = V - I_a R_a = 220 - (80)(0.5) =$ **180 V** **2M**

Q.3) a) Advantages of capacitor start induction motor **2M**

- Improved or higher starting torque than split phase motors.
- Better performance as compared to split phase induction motor

Disadvantages of capacitor start induction motor **2M**

- Low power factor under running conditions.
- Since the auxiliary winding is only a light winding, the motor does not develop sufficient torque to start heavy loads.

b) Applications of induction motor:-

Squirrel cage motor **(Any two):-** Pumps, Fans, Blowers, Compressors, Lathe machines, Industrial drives etc. **2M**

Slip ring motor **(Any two):-** Cranes, Lifts, Hoists Industrial Drives etc. **2M**

c) P = 6, f = 50 Hz

i) Ns = 120f/P = **1000 rpm** **1M**

ii) s = 0.06 ; N =Ns(1-s) = **940 rpm** **1M**

iii) fr = sf = (0.06)(50) = **3 Hz** **1M**

iv) At standstill fr = sf = (1) (50) = **50 Hz** **1M**

v) Speed of the motor when the slip is 0 is N = Ns = **1000 rpm** **1M**

vi) Speed of the motor when the slip is 1 is N = **0 rpm** **1M**

OR

Q4) a) Applications:-

Resistance split phase single phase induction motor **(Any two)** **2M**

Small drill presses, shop grinders, air conditioning, and heating belt-driven blowers and small belt-driven conveyors.

Capacitor start single phase induction motor **(Any two)** **2M**

These motors have high starting torque hence they are used in conveyors, grinder, refrigerators, air conditioners, compressor, etc.

b) Advantages of squirrel cage and slip ring type of motor-

The following are the advantages of the cage motor **(Any two)** **2M**

1) The cage motor is cheaper, and the construction is robust.
2) The absence of the brushes reduces the risk of sparking.

3) Its Maintenance is less.
4) The power factor is higher
5) The efficiency of the cage motor is higher.

The following are the advantages of phase wound motor **(Any two)** **2M**

1) High starting torque
2) Low starting current.
3) For controlling the speed of the motor, an external resistance can be added in the circuit.
4) Speed control from rotor side is possible
5) Electrical power developed in rotor can be recovered.

c) P = 2, f = 50 Hz

i) Ns = 120f/P = **3000 rpm** **1M**

ii) s = 0.05 ; N =Ns(1-s) = **2850 rpm ;** fr = sf = (0.05)(50) = **2.5 Hz** **2M**

iii) N = 2800 rpm s = Ns – N/Ns = **0.066**; fr = sf = (0.066)(50) = **3.33 Hz** **2M**

iv) Speed of the motor when the slip is 0 is N = Ns = **3000 rpm** **1M**

Q.5) Attempt following multiple choice questions: **[2x10=20 marks]**

a) iii 33.33 W **[2]**

b) ii 10 + j 62.84 **[2]**

c) iv 4 A **[2]**

d) i 920 W **[2]**

e) i 9 Ω **[2]**

f) iv 0.5 **[2]**

g) ii 20 A **[2]**

h) i 90 % **[2]**

i) i shell **[2]**

j) iii 1 A **[2]**