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

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Paper Code: [illegible]

DEC 2018 / BACKLOG

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

COURSE NAME: BASIC ELECTRICAL ENGG.

COURSE CODE: ET 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) $P=4$, $Z=600$, $I_l = 21$ A, $I_f = 1$ A, $\Phi = 0.02$ Wb, $T_g = ?$ $N = ?$

$I_a = I_l - I_f = 21 - 1 = 20$ A, Lap winding $A = P = 4$ **2M**

$E_b = 200$ V

But $E_b = \Phi ZNP/60A = 200$ V

$N = 60\,A*E_b / \Phi ZP =$ **1000 rpm** **2M**

$T_g = 0.159\,(PZ/A)\,\Phi I_a =$ **38.19N-m** **2M**

b) Derivation steps for Induced EMF for DC Generator **4M**

For one revolution of the conductor,

Let, Φ = Flux produced by each pole in Weber (Wb) and

P = number of poles in the DC generator. Therefore,

Total flux produced by all the poles = $\Phi * P$

And, Time taken to complete one revolution = 60/N

Where, N = speed of the armature conductor in rpm.

Now, according to Faraday's law of induction, the induced emf of the armature conductor is denoted by "e" which is equal to rate of cutting the flux.

Therefore,

$$e = \frac{d\phi}{dt} \ and \ e = \frac{total\ flux}{time\ take}$$

Induced emf of one conductor is

$$e = \frac{\phi P}{\frac{60}{N}} = \phi P \frac{N}{60}$$

Let us suppose there are Z total numbers of conductor in a generator, and arranged in such a manner that all parallel paths are always in series.

Here, Z = total numbers of conductor A = number of parallel paths

Then, Z/A = number of conductors connected in series

We know that induced emf in each path is same across the line

Therefore, induced emf of DC generator

Eg = emf of one conductor × number of conductor connected in series.

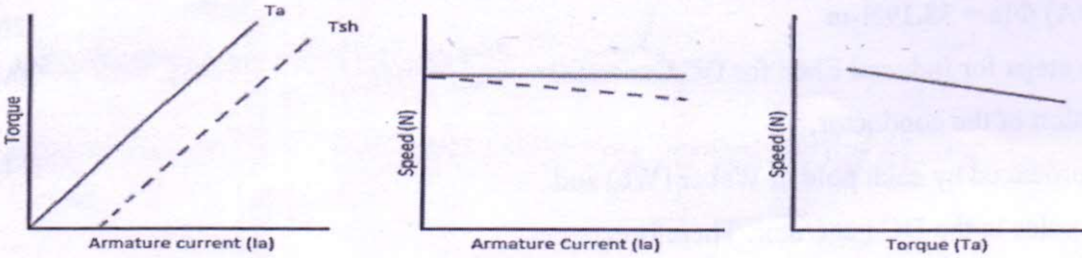
Therefore, Induced emf Eg is given by,

Eg = ΦZNP/60 A **2M**

c) Applications of dc shunt motor **(Any 2)** - Lathe machines, Centrifugal pumps, Machine tools, Fans and blowers, reciprocating pumps **2M**

Applications of dc series motor **(Any 2)** - Traction i.e. Electric locomotives, Rapid transit systems, Trolley, cars, Cranes and hoists, Conveyors **2M**

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



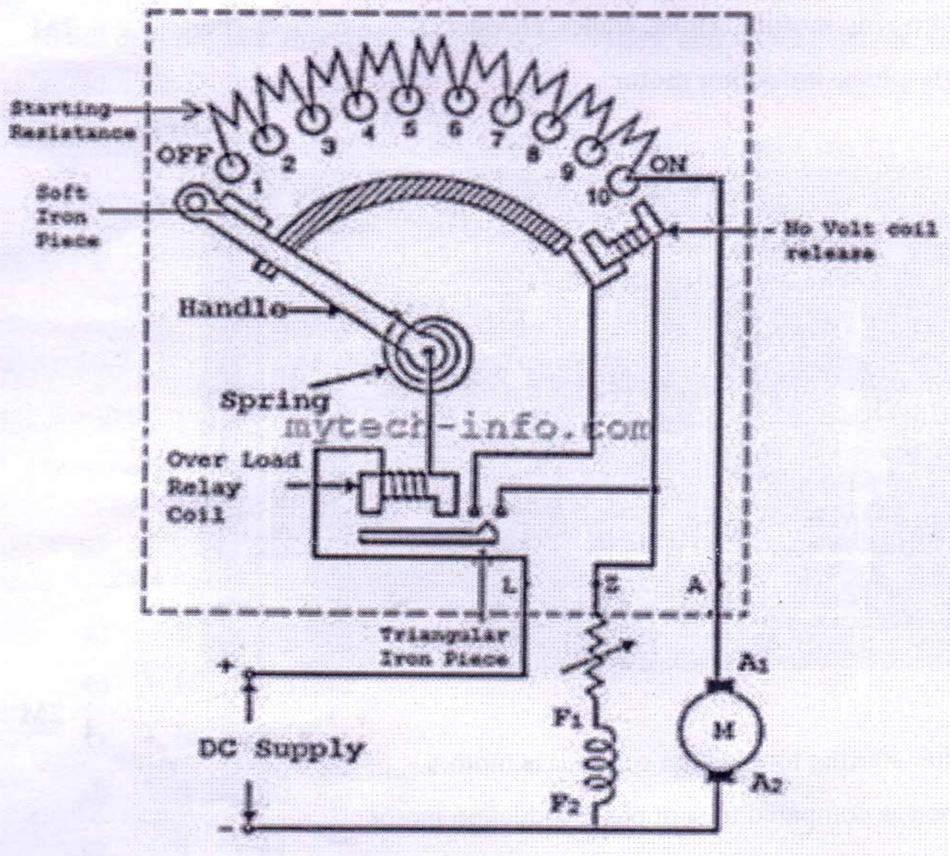
b) Φ per pole = 6 mWb, Z = 600, N = 1200 rpm, P = 4, A = P = 4 as lap winding

Now, E_g = ΦZNP/60A = **72 V** **3M**

For wave winding, A = 2 and Eg = 72 V Hence, N = 60 E_g A/ΦZP

Therefore, N = **600 rpm** **3M**

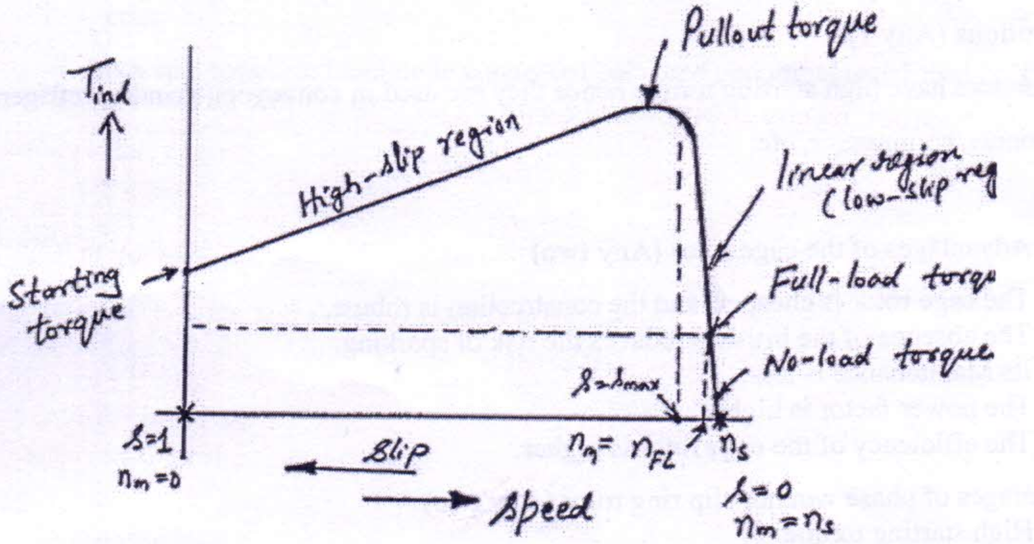
c) Three point starter diagram:-



4M

Q.3) a)_Torque-slip characteristics of three phase induction motor

Diagram **2M**



Appropriate explanation of characteristics (without mathematical expressions)

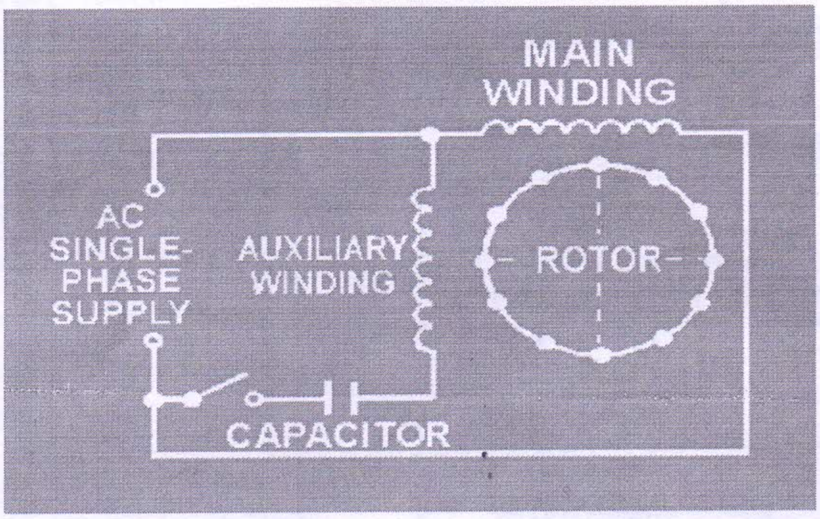
For small values of slip s, the torque is directly proportional to s. For large values of slip s, the torque is inversely proportional to s. **2M**

b) Any 2 applications of squirrel cage motor- Lathe machines, fan, blower, profiting machines, etc. **2M**

Any 2 applications of slip ring motor- Hoist, cranes, elevator, lifts etc. **2M**

c) Capacitor-start single-phase induction motor

Neat labeled Diagram **2M**



Advantages **2M**

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

Disadvantages (Any 1) **1M**

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

Applications (Any 1) **1M**

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

Q4) a) Advantages of the cage rotor **(Any two)** **2M**

1) The cage rotor 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 rotor is higher.

Advantages of phase wound/ slip ring rotor **(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.

b) Applications of resistance split phase induction motor **(Any 2)** **2M**

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

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

Conveyors, grinders, refrigerators, air conditioners, compressors etc.

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= 6.6%;** 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)	ii	30	**[2]**
b)	iv	6+j 31.42	**[2]**
c)	iv	4 A	**[2]**
d)	ii	Zero	**[2]**
e)	ii	1 Ω	**[2]**
f)	i	1	**[2]**
g)	iii	6.37 A	**[2]**
h)	iii	250 W	**[2]**
i)	i	core	**[2]**
j)	iii	Both star connected and delta connected balanced and unbalanced load	**[2]**