| G.R. No. | |
|---|---|

# DECEMBER 2018 / END-SEM (SOLUTION)

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

## COURSE NAME: BASIC ELECTRICAL ENGINEERING

## COURSE CODE: ET 10182A

## (PATTERN 2018)

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

**Q 1) a)**

i. Current in 5Ω considering only source of 4V = I'= 0.4236A **2M**
ii. Current in 5Ω considering only source of 6V = I''= 0.3529 A **1M**
iii. Current flowing through 5Ω = $I_{5\Omega}$ = I'- I''= **0.0706 A** **1M**

**OR**

**b)**

i. Thevenin's equivalent resistance= $R_{EQ}$= 4.44 Ω **2M**
ii. Thevenin's voltage = $V_{TH}$= 0.67V **1M**
iii. Current flowing through 5Ω = $I_{5\Omega} = V_{TH}/(R_{EQ}+R_L)$ = **0.0706 A** **1M**

**Q 2) a)**

i. Drawing impedance triangle **1M**
ii. Formula of impedance: $Z=R + j X_L$ (Ω) or Z=V/I (Ω) **1M**
iii. Formula of phase angle: $\phi = \tan^{-1}(X_L / R)$ degrees or $\phi = \cos^{-1}(R / Z)$ degrees **1M**
iv. Nature of power factor: Lagging **1M**

**OR**

**b)**

i. Capacitive reactance= $X_C = 1/2\pi fC$= 63.66 Ω **1M**
ii. Impedance of circuit=Z =8-j63.66 Ω = $64.2 \angle -82.9^0$ Ω **1M**
iii. Power factor of circuit= cosϕ=R/Z= 0.124 leading **2M**

**Q 3) a)**

i. Any two advantages of single phase autotransformer **2M**
ii. Any two disadvantages of single phase autotransformer **2M**
iii. Any two relevant applications of single phase autotransformer **2M**

**OR**

**b)**

i. Derivation of e.m.f. equation of single phase transformer (4 steps) **4M**
ii. Stating expressions for e.m.f. induced in primary and secondary winding **2M**

**b)**

i. Output energy= Eo= mgh= 176580 J **1M**

ii. Input energy= Ein= Eo/ efficiency= 294300 J **1M**

iii. Power input= Ein/ time= **4905 W** **1M**

iv. Daily Cost of energy= Power in KW * time* rate= **Rs. 44.145/-** **1M**

**OR**

**Q 5) a)**

Energy consumption by different appliances per day:

i. 4 fluorescent tubes each of 40 W for 5 hours= 4*40* 5= 800 Wh **1M**

ii. 2 kW electric geyser for 1 hour= 2000 Wh **1M**

iii. 800 W electric iron for 45 minutes= 800*0.75= 600 Wh **1M**

iv. Other miscellaneous load of 500 W for 3 hours = 1500 Wh **1M**

v. Electricity bill for a month =4.9 Kwh* 30* 3.5= **Rs. 514.5/-** **2M**

**b)** Any four features of a switchgear e.g. Reliability, discrimination, quick operation, provision for manual control, provision for instruments etc. (1 mark each) **4M**

**Q 6) a)**

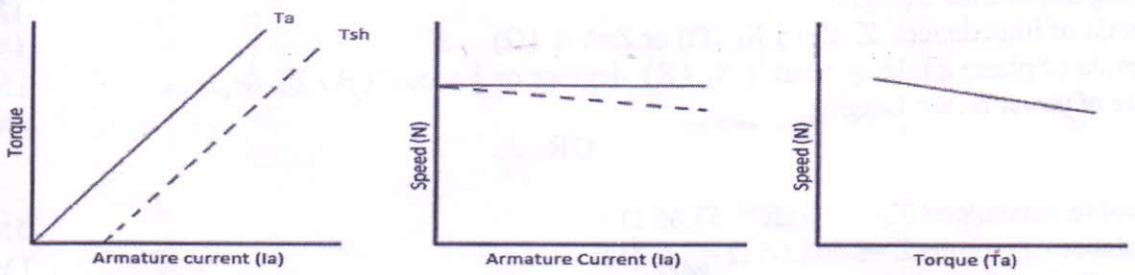
i. Eg = ΦZNP/60A (stating formula) **1M**

ii. For Lap winding A = P = 8 **1M**

iii. Using formula, Z = 1260 **2M**

iv. No. of conductors per slot = Z/ no of slots = 1260/140 = **9** **2M**

**b)** Speed- armature current characteristics (2 marks) and torque-armature current characteristics (2 marks) of a dc shunt motor **4M**




**OR**

**Q 7) a)**

i. Ish = 220/100 = 2.2 A **1M**

ii. Ia = 22 – 2.2 = 19.8 A **1M**

iii. Eb = V – IaRa = 220 – (19.8)(0.5) = 210.1 V **1M**

iv. Eb = ΦZNP/60A = 210.1 V; For Lap winding A = P = 4 **1M**

v. N = 60EbA/ΦZP = **2101 rpm** **1M**

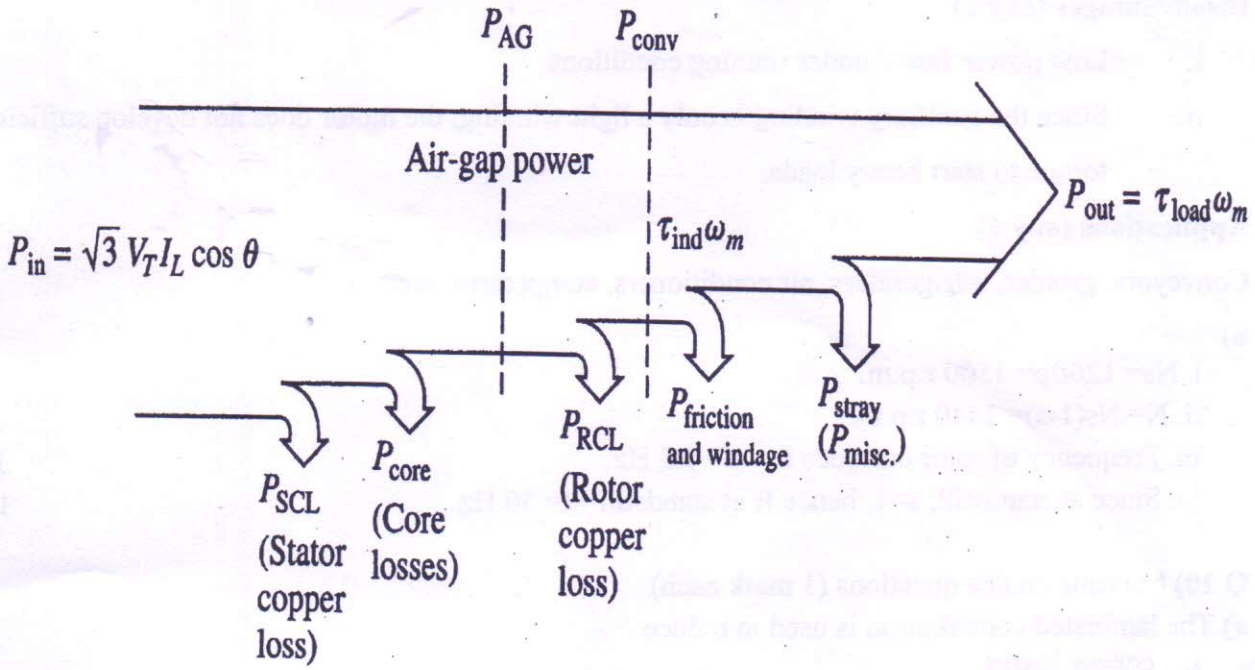
vi. Tg = 0.159 (PZ/A) ΦIa = **18.90 N-m** **1M**

**b)** Classification of dc machines (separately excited, shunt, series and compound) **4M**

**Q 8) a) Each point for 1 mark** **6M**

| Basis For Comparison | Slip Ring Motor | Squirrel Cage motor |
|---|---|---|
| Rotor construction | Cylindrical laminated core with parallel slots and each slot consist one bar. | The slots of the rotor are not parallel, but are skewed. |
| Starting Torque | High | Low |
| Maintenance requirement | Frequent maintenance required | Less maintenance required |
| Cost | Costly | Cheap |
| Losses | High | Low |
| Efficiency | Low | High |

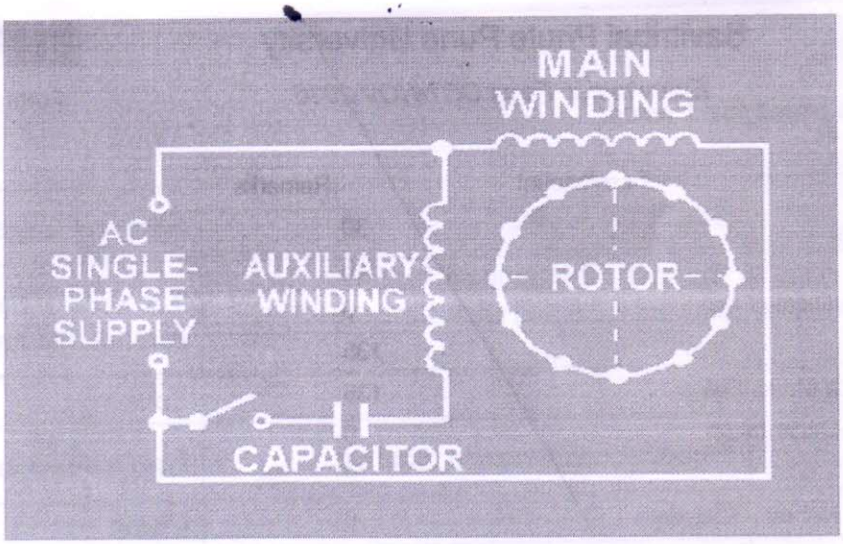
**b)** Power flow diagram in case of a three phase induction motor. **4M**




**OR**

**Q 9) a) Capacitor-start single-phase induction motor**

**Diagram** **2M**




**Advantages** **2M**

i. Improved or higher starting torque than split phase motors.

ii. Better performance as compared to split phase induction motor

**Disadvantages (any 1)** **1M**

i. Low power factor under running conditions

ii. Since the auxiliary winding is only a light winding, the motor does not develop sufficient torque to start heavy loads.

**Applications (any 1)** **1M**

Conveyors, grinder, refrigerators, air conditioners, compressor, etc.

**b)**

i. Ns= 120f/p= 1500 r.p.m. **1M**

ii. N= Ns(1-s)= 1440 r.p.m. **1M**

iii. Frequency of rotor current= fr= sf= 1.5 Hz **1M**

iv. Since at standstill, s=1, hence fr at standstill= f= 50 Hz **1M**

**Q 10)** Multiple choice questions (1 mark each)

**a)** The laminated construction is used to reduce

i. copper losses
ii. hysteresis loss
**iii. eddy current losses**
iv. friction and windage losses

**b)** The nature of speed-torque characteristics of a DC series motor is _____ .

i. a straight line
**ii. parabolic**
iii. exponential
iv. rectangular hyperbola

**c)** Which of the following is the correct expression for gross torque developed by armature in case of a lap wound DC motor.

i. **0.159ZΦIa**
ii. 0.159 (PZ/2) ΦIa
iii. 0.159 (2PZ) ΦIa
iv. 0.159 (PZ/2N) ΦIa

**d)** Find the number of poles required, when the frequency is 50Hz and synchronous speed of the motor is 500 rpm

i. 10
**ii. 12**
iii. 24
iv. 6

**e)** At stand still condition of an induction motor, the value of slip is

**i. 1**
ii. 0
iii. infinite
iv. between 0 and 1

**f)** A single-phase induction motor is

i. inherently self-starting with high torque
ii. inherently self-starting with low torque
**iii. inherently non-self-starting with low torque**
iv. inherently non-self-starting with high torque