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# B.E. DEGREE EXAMINATIONS: APRIL / MAY 2009

Third Semester

## ELECTRONICS AND COMMUNICATION ENGINEERING

## U07EC301 Electrical Machines and Power System

**Time: Three Hours** **Maximum Marks: 100**

**Answer ALL the Questions:-**

**PART A (20 x 1 = 20 Marks)**

1. Critical resistance of a DC shunt machine is

   (A) less than shunt résistance (B) greater than shunt resistance

   (C) Equal to shunt resistance (D) Equal to field resistance

2. The purpose of the inter pole is to

   (A) to get more induced emf (B) to get more torque

   (C) to get sparkless commutation (D) to increase overall efficiency.

3. The speed of DC motor is

   (A) Always constant (B) directly proportional to back emf

   (C) Directly related to flux (D) inversely proportional to the sum of emf and flux

4. Which DC motor is preferred for cranes and hoists?

   (A) shunt motor (B) cumulatively compounded motor

   (C) series motor (D) differentially compounded motor

5. Which of the following does not change in an ordinary transformer?

   (A) voltage (B) current (C) frequency (D) ohmic loss

6. For a transformer, the condition for maximum efficiency is

   (A) hysteresis loss = eddy current loss (B) core loss = hysteresis loss

   (C) copper loss = iron loss (D) total loss = 50% of copper loss

7. A transformer can have zero voltage regulation at

   (A) zero power factor (B) lagging power factor

   (C) unity power factor (D) leading power factor

8. The efficiency of a 450/200 V transformer at full load, 0.8 p.f lagging is 95%. The efficiency at full load at 0.8 p.f leading is

   (A) 95% (B) 95.5% (C) 99% (D) 90%

9. The phenomenon of crawling occurs in induction motors due to

   (A) low voltage (B) high load

   (C) jammed bearings (D) harmonics developed in the motor

10. Starting torque of an induction motor is proportional to

    (A) supply voltage (B) $(\text{supply voltage})^2$ (C) starting current (D) $(\text{load current})^{1/2}$

11. Slip rings for induction motors are made of

(A) aluminum (B) carbon (C) hard drawn copper (D) cobalt steel

12. Direct on line starting current as compared with star delta starting current is

(A) 2 times (B) 3 times (C) equal (D) 1/3 times

13. The damping winding in a synchronous motor is generally used to

(A) provide starting torque only (B) reduce noise level

(C) reduce eddy current (D) to prevent hunting and provide the starting torque

14. Synchronous motor can operate at

(A) lagging power factor only (B) leading power factor only

(C) unity power factor only (D) any power factor

15. The armature current of a synchronous motor has large values for

(A) low excitation only (B) high excitation only

(C) both low and high excitation (D) depends on other factors

16. In case of a three phase synchronous motor, maximum speed variation is

(A) 10% (B) 5% (C) 3% (D) zero

17. The skin effect of a conductor will reduce as the

(A) diameter increases (B) frequency increases

(C) the permittivity of the conductor (D) the resistivity increases

18. In high voltage transmission lines the top most conductor is

(A) R-phase conductor (B) Y-phase conductor

(C) B-phase conductor (D) earth conductor

19. Which distribution system is more reliable?

(A) ring main system (B) tree system

(C) radial system (D) all are equally reliable

20. The main advantage of a.c transmission system over d.c transmission system is

(A) easy transformation (B) less losses

(C) less insulation problems (D) less problem of instability

**PART B (5 x 16 = 80 Marks)**

21 (a) (i) Derive the EMF equation of a DC generator, there by indicate the different types of DC generators. (8)

(ii) A DC shunt motor fed from 220 V supply drives a centrifugal pump whose torque varies as square of the speed and takes 45 A when running at 900 rpm. What resistance must be inserted in the armature circuit in order to reduce the speed to 700 rpm? The armature and field resistances of the motor are 0.1 ohm and 110 ohm respectively. (8)

(OR)

21 (b) (i) Explain clearly with neat circuit diagram, how efficiency of a DC motor and generator can be predetermined form Swinburne's test. (8)

(ii) A 4 pole, 250 V, 7.5 kW wave connected shunt motor has an armature resistance of 0.4 ohm and a field resistance of 125 ohm. Estimate approximately the current taken by the motor on no-load if the full load efficiency of the motor is 86% (8)

22. (a) (i) Derive the EMF equation of a single phase transformer and indicate the component of no load current. (8)

(ii) A 150 kVA single phase transformer working at unity power factor has an efficiency of 96% both at 70% of full load and at full load. Find the load at which maximum efficiency occurs and also the value of maximum efficiency. (8)

(OR)

22. (b) (i) Explain clearly how regulation and efficiency can be pre determined from no load and short circuit of single phase transformer. (8)

(ii) Explain with a neat diagram, the constructional details of a three phase power transformer also mention the importance of breather, conservator and protective relay. (8)

23. (a) (i) Derive the torque equation of a three phase induction motor also obtain the relation for starting torque to full load torque and maximum torque to full load torque. (8)

(ii) Explain clearly the principle of operation of single phase capacitor start induction motor with necessary phasor diagram. (8)

(OR)

23. (b) (i) Determine the equivalent circuit of a three phase induction motor from no load and blocked rotor test. Also explain how efficiency can be predetermined. (8)

(ii) Explain clearly the principle of operation of single phase universal motor. Mention any four applications of this motor. (8)

24. (a) (i) What are the various modes of operation of a stepper motor?. Explain any one method in detail (8)

(ii) Derive the EMF equation of a three phase synchronous generator. Explain clearly the pitch factor and distribution factor. (8)

(OR)

24. (b) (i) Explain with necessary diagram, the construction and operation of a brushless alternator (8)

(ii) A three phase, 16 pole, star connected alternator has 240 stator slots with eight conductors per slot and the conductor of each phase are connected in series. The coil span is 144 electrical degree. Determine the phase and line EMFs if the machine speed is at 375 rpm and the flux per pole is 6.1 milli Weber. (8)

25. (a) (i) Explain with a single line diagram, the power distribution from the generation till the consumer end (8)

(ii) With a block diagram, explain the operation of EHVDC transmission system (8)

(OR)

25. (b) (i) Give a sketch of the cross section of LTUG cable and explain the function of each part. (8)

(ii) What are the different types of AC distribution systems. Explain ring main system of distribution in detail (8)

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