BIRLA INSTITUTE OF TECHNOLOGY
MESRA – 835215, RANCHI, INDIA

UG

Name: ……………………………………………. Roll No.: …………………………………………..
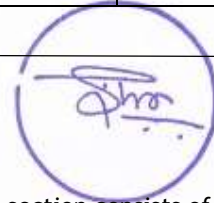
Branch: ……………………………………………. Signature of Invigilator: ……………………

Semester: IVth   Date: 28/04/2022 (MORNING)

Subject with Code: **EE251 DC MACHINES AND TRANSFORMERS**

Marks Obtained	Section A (30)	Section B (20)	Total Marks (50)

INSTRUCTION TO CANDIDATE

1. The booklet (question paper cum answer sheet) consists of two sections. First section consists of MCQs of 30 marks. Candidates may mark the correct answer in the space provided / may also write answers in the answer sheet provided. The Second section of question paper consists of subjective questions of 20 marks. The candidates may write the answers for these questions in the answer sheets provided with the question booklet.

2. The booklet will be distributed to the candidates before 05 minutes of the examination. **Candidates should write their roll no. in each page of the booklet.**

3. Place the Student ID card, Registration Slip and No Dues Clearance (if applicable) on your desk. All the entries on the cover page must be filled at the specified space.

4. Carrying or using of mobile phone / any electronic gadgets (except regular scientific calculator)/chits are strictly prohibited inside the examination hall as it comes under the category of unfair means.

5. No candidate should be allowed to enter the examination hall later than 10 minutes after the commencement of examination. Candidates are not allowed to go out of the examination hall/room during the first 30 minutes and last 10 minutes of the examination.

6. Write on both side of the leaf and use pens with same ink.

7. The medium of examination is English. Answer book written in language other than English is liable to be rejected.

8. All attached sheets such as graph papers, drawing sheets etc. should be properly folded to the size of the answer book and tagged with the answer book by the candidate at least 05 minutes before the end of examination.

9. The door of examination hall will be closed 10 minutes before the end of examination. Do not leave the examination hall until the invigilators instruct you to do so.

10. Always maintain the highest level of integrity. Remember you are a BITian.

11. Candidates need to **submit the question paper cum answer sheets before leaving the examination hall**.

CLASS: UG   SEMESTER: 4TH

BRANCH: EEE   (MESRA/PATNA/DEOGHAR/JAIPUR)   SESSION: SP22

SUBJECT: EE-251 DC Machines and Transformers (DCMT)

TIME: 2Hrs   **FULL MARKS:50**

INSTRUCTIONS:
1. The question paper contains Two (2) sections. Section A comprises 30 Marks, and Section B consists of 20 marks.
2. Both Section A and Section B are compulsory.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data handbook/Graph paper etc., to be supplied to the candidates in the examination hall.

Section-A
Answer all questions (1×30=30)

1. The current drawn by a 220V dc motor of armature resistance 0.5 and back emf 200V is
(a) 40 A
(b) 44 A
(c) 400 A
(d) 440 A

2. A dc shunt generator is supplying a load of 1.8kW at 200V. Its armature and field resistance are 0.4 ohm and 200 ohms, respectively. What is the generated emf?
(a) 190 V
(b) 196 V
(c) 204 V
(d) 210 V

3. When is the mechanical power developed by a dc motor maximum?
(a) Back emf is equal to applied voltage
(b) Back emf is equal to zero
(c) Back emf is equal to half the applied voltage
(d) None of the above

4. How many segments will be there for the commutator of a 6-pole d.c machine having a simple wave wound armature with 72 slots?
(a) 73
(b) 72
(c) 71
(d) 70

5. At 1200 rpm, the induced emf of a dc machine is 200V. For an armature current of 15A the electromagnetic torque produced would be
(a) 23.8 N-m
(b) 238 N-m
(c) 2000 N-m
(d) 3000 N-m

6. Two generators A and B have 6-poles each. Generator A has wave wound armature while generator B has lap wound armature. The ratio of the induced e.m.f. is generator A and B will be
(a) 2:3
(b) 3:1
(c) 3:2
(d) 1:3

7. A shunt generator running at 1000 r.p.m has generated e.m.f. as 200 V. If the speed increases to 1200 r.p.m., the generated emf will be nearly
(a) 150 V
(b) 175 V
(c) 240 V
(d) 290 V

8. The purpose of providing dummy coils in a generator is
(a) to reduce eddy current losses
(b) to enhance flux density
(c) to amplify voltage
(d) to provide mechanical balance for the rotor

9. In over compounded generator, terminal voltage is
(a) almost zero
(b) less than no load voltage
(c) more than no load voltage
(d) equal to no-load voltage

10. Armature reaction in a generator result in
(a) Demagnetisation of leading pole tip and magnetisation of trailing pole tip
(b) Demagnetisation of trailing pole tip and magnetisation of leading pole tip
(c) Demagnetisation the centre of all poles
(d) Magnetisation the centre of all poles

11. Negative voltage regulation of a transformer indicates that the load is
(a) capacitive only
(b) inductive only
(c) inductive or resistive
(d) none of the above

12. The function of breather in a transformer is
(a) to provide oxygen inside the tank
(b) to cool the coils during reduced load
(c) cool the transformer oil
(d) to arrest flow of moisture when outside air enters the transformer.

13. In a star-star transformer with ungrounded neutral, the third harmonic voltages are present in
(a) line voltage
(b) phase voltage
(c) both in line voltage and phase voltage
(d) none of the above

14. A 2:1 transformer has impedance of 1+5j ohm on l.v side and 9+45j ohm on h.v. side. The total equivalent impedance at the h.v. terminals is:
(a) 8+40j
(b) 37+185j
(c) 10+50j

(d) 13+65j

15. The effect of 3rd harmonics in three phase transformers
(a) Neutral oscillation
(b) Over voltage stress
(c) Both (a) and (b)
d) None of the above

16. In an open delta connection, the utilization factor is
(a) 0.577
(b) 0.866
(c) 0.924
(d) 1

17. Distribution transformers are generally connected in
(a) Dz6
(b) Dd0
(c) Dy11
(d) Dd6

18. Scott-connected transformer is used to convert
(a) single phase to three phase
(b) three phase to single phase
(c) three phase to two phase
(d) two phase to single phase

19. Compared to Delta-Delta bank, the capacity of open delta (VV) bank in percentage is
(a) 57.7
(b) 66.7
(c) 50
(d) 86.6

20. A transformer having 1000 primary turns is connected to 250 V ac supply, for a secondary voltage of 400 V, the number of secondary turns should be
(a) 1600
(b) 250
(c) 400
(d) 1250

21. A 444V, 50 Hz supply is provided to the primary of an ideal transformer having 200 number of turns. The value of flux generated through primary will be
(a) 2.25 mWb
(b) 10 mWb
(c) 1 mWb
(d) 25 mWb

22. An auto transformer having a transformation ratio of 0.8 supplies a load of 3kW, the power transferred conductively from primary to secondary is in kW
(a) 0.6
(b) 2.4
(c) 1.5
(d) 2.7

23. The advantage of auto transformer over ordinary transformer is
(a) saving of copper

(b) to reduce current
(c) to get variable voltage
(d) both a and b

24. A 4-pole lap connected DC machine has total armature current of 20A. The current in each parallel path will be
(a) 80 A
(b) 10 A
(c) 40 A
(d) 20 A

25. A wave wound 6-pole DC generator has 50 slots with 20 conductors per slot and flux per pole of 50 mWb. At which speed, the generator will produce an emf of 250 V?
(a) 100 rpm
(b) 200 rpm
(c) 300 rpm
(d) 600 rpm

26. The armature reaction in d.c. machine can be reduced by
(a) Increasing the length of air gap
(b) Decreasing the length of air gap
(c) Increasing the number of poles
(d) Decreasing the number of poles

27. A DC shunt generator has armature and field resistance of 0.1 ohm and 145 ohms, respectively. If the induced voltage is 600V and armature current is 200A, the value of field current will be:
(a) 4 A
(b) 5 A
(c) 6 A
(d) 2.5 A

28. When two D.C. series generators are running in parallel, an equalizer bar is used
(a) to increase the speed and hence generated e.m.f.
(b) to increase the series flux
(c) so that two similar machines will pass approximately equal currents to the load
(d) to reduce the combined effect of armature reaction of both machines

29. The terminal voltage of a series generator is 150 V when the load current is 5 A. If the load current is increased to 10 A, the terminal voltage will be
(a) 150 V
(b) less than 150 V
(c) greater than 150 V
(d) none of the above

30. The number of armature parallel paths in a two-pole D.C. generator having duplex lap winding is
(a) 2
(b) 4
(c) 6
(d) 8

Section-B
Answer any four questions (4×5=20)

1. (a) Derive the condition for maximum voltage regulation of a transformer.   3
    (b) A single-phase transformer has a maximum efficiency of 90% at full load and unity power factor. What is the efficiency at half load at the same power factor?   2

2. (a) Draw the winding connection and phasor diagram of following vector groups:
    (i) Dy11 (ii) Dz6   3
    (b) Why the secondary of a current transformer is never kept open circuited?   2

3. (a) What is tertiary winding? Why is it connected in delta?   2
    (b) A 3-phase 900 kVA, 3 kV / 3 kV (Δ/Y), 50 Hz transformer has primary (high voltage side) resistance per phase of 0.3 Ω and secondary (low voltage side) resistance per phase of 0.02 Ω. Iron loss of the transformer is 10 kW. Determine the full load efficiency of the transformer at unity power factor.   3

4. (a) State the necessary conditions for voltage build up in a DC shunt generator.   2
    (b) A shunt generator delivers 50kW at 250V and 400 rpm. The armature and field resistances are 0.02 Ω and 50 Ω, respectively. Calculate the speed of the machine running as shunt motor and taking 50kW at 250V. Allow 1V drop for each brush.   3

5. (a) Why are DC series motors never used in belt drives?   2
    (b) A 250 V DC shunt motor on load runs at 1000 rpm and takes 5 A. The total armature and shunt field resistances are 0.2 Ω and 250 Ω, respectively. Calculate the speed when loaded and taking current of 50A if the armature reaction weakens the filed by 3%.   3

6. (a) Why are differentially compound DC generators suitable for welding purpose?   1.5
    (b) In field weakening mode, the power of a DC machine is constant. Justify.   1.5
    (c) DC series motors are used in traction drives. Explain.   2