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PRESIDENCY UNIVERSITY BENGALURU

SCHOOL OF ENGINEERING

END TERM-SUMMMER TERM-EXAMINATION - AUGUST 2024

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| **Semester :5** | **Date : 06.08.2024** |
| **Course Code : EEE3004** | **Time :09:30am to 12:30pm** |
| **Course Name : Special Electrical Machines** | **Max Marks :100** |
| **Program :B.Tech** | **Weightage :50%** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Question paper consists of 3 parts.*
3. *Scientific and non-programmable calculator are permitted.*
4. *Do not write any information on the question paper other than Roll Number.*

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| **PART A** | | | |
| **ANSWER ANY 4 QUESTIONS 4Q X 5M=20M** | | | |
| 1 | Explain with a sketch unipolar and bipolar winding of stepper motor. | (CO 1) | [Knowledge] |
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| 2 | Explain the dynamic characteristics of stepper motor. | (CO 1) | [Knowledge] |
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| 3 | Bring out the main difference between PMDC and BLDC | (CO 2) | [Knowledge] |
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| 4 | With a neat sketch, explain the current regulators used for Switched reluctance motor (SRM). | (CO 2) | [Knowledge] |
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| 5 | A stepper is motor is wound for two-phases and four-poles. It has 10 rotor poles. Find its resolution. | (CO 3) | [Knowledge] |
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| 6 | Compare SRM and stepper motor. | (CO 4) | [Knowledge] |
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| **PART B** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 10M=50M** | | | |
| 7 | The most common way to control a BLDC motor is to use Hall sensors to determine the rotor position. A fixed point DSP controller used for various applications with advanced control solution. Explain the block diagram of DSP based SRM motor control. | (CO1) | [Comprehension] |
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| 8 | The open-loop control of the stepper motor cannot avoid the inherent disadvantages of the stepper motor itself, that is, resonance, oscillation, step loss and difficult to achieve high speed. State how the disadvantages can be eliminated. Justify your answer with suitable explanation. | (CO2) | [Comprehension] |
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| 9 | A permanent sine wave motor  mainly consists of a static portion called a stator and a rotating section called a rotor. The laminations for axial air gap devices are probably generated by rolling them with soft steel strips. Explain the principle of operation of a brushless type of permanent sine wave motor. | (CO2) | [Comprehension] |
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| 10 | SRM is normally designed for efficient conversion of significant amounts of power, stepper motors are more usually designed to maintain step integrity in position controls. Explain any two power controller circuit for switched reluctance motor. | (CO3) | [Comprehension] |
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| 11 | Stepper Motor is an electromechanical device which actuates a train of steps movements of shaft in response to train of input pulses. Formulate the construction & principle of a PM type stepper motor with different modes of excitation. | (CO3) | [Comprehension] |
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| 12 | Motor drives often require transducers for control and protection, and there has been progress in current-sensor and shaft position sensor technology. Due to their internal structure, some motors do not require a sensor to detect the motor position, does not need complex calculations or tuning to work properly. In general, the control effort is lower compared to other motors and can get high position accuracy. According to you which special electrical machine have the above features. Explain in detail about the working principle, constructional operation and types of that stated motor with suitable reasons. | (CO4) | [Comprehension] |
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| 13 | Sensored brushless motors are brushless motors with positional sensors in them. These positional sensors feedback positional information to the controller which can then be used to ensure the drive pattern delivered to the controller syncs perfectly with the rotor position. Can we have sensor less BLDC motors in market or not ? Interpret your answer with sutable reasons and diagrams. | (CO4) | [Comprehension] |
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| **PART C** | | | |
| **ANSWER ANY 2 QUESTIONS 2Q X 15M=30M** | | | |
| 14 | A vehicle is propelled by a linear induction motor. The motor has 100 poles with a pole pitch of 0.5 m. Find the vehicle speed in kmph when the vehicle is running with a slip of 0.25 at a frequency of 50 Hz. | (CO1) | [Application] |
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| 15 | A BLDC motor has a no load speed of 6000 rpm when connected to 120 V DC source. Armature resistance is 2.5 Ω. Find the speed when it is supplied with 60V and developing a torque of 0.5 Nm. Neglect constant losses. The no load current is 1A. | (CO2) | [Application] |
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| 16 | A 3 phase, 4pole, 60 Hz, 230V star connected synchronous reluctance motor has direct axis and quadrature axis synchronous reactances of 22.5 Ω and 3.5 Ω respectively. The load torque of 12.5 Nm. The voltage to frequency ratio is maintained constant at rated value. Find (a) torque angle, (b) line current and (c) power factor. Neglect rotational | (CO3) | [Application] |
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