

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)**

**CLASS: B.TECH  
BRANCH: EEE**

**SEMESTER : VI  
SESSION : SP/2023**

**SUBJECT: EE443 UTILIZATION OF ELECTRICAL POWER**

**TIME: 3 Hours**

**FULL MARKS: 50**

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
  2. Attempt all questions.
  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 hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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|--------|--|--------|-------|
| Q.1(a) | (i) Define co-efficient of adhesion . Clearly explain Which Speed-Torque characteristic (more drooping or less drooping) will have more co efficient of adhesion and Why ?<br>(ii) Which connection series or parallel for DC series motor will have better co efficient of adhesion ? and Why ?   | [5] 01 | 01+02 |
| Q.1(b) | A 80 tonne motor coach is driven by 4 motors, each developing 2500 Nm during acceleration while moving up gradient of 20 in 1000, gear teeth ratio (N2/N1) is 4, gear efficiency-95%, Wheel radius - 0.5m, train resistance is 25 N/tonne, Effective mass due to rotational effect -10% higher, Calculate the time taken to attain a speed of 100 Kmph.  | [5] 01 | 03    |
| Q.2(a) | An Electric train weighing 500 tonnes moves up a gradient of 1% with following speed time curve- (I) Uniform acceleration of 1.5 Kmphps for 100 sec (ii) Constant speed for 60 min (iii) Coasting for 3 min (iv) Dynamic braking at 2 Kmphps to rest. Determine (i) Average speed (ii) Specific energy consumption<br>Train Resistance-30 N/tonne, Rotational effect on weight-10% more, Overall efficiency-85%  | [5] 01 | 03    |
| Q.2(b) | With a neat circuit diagram, Explain the Working of 25 KV AC Traction System employing a Two Stage AC-DC Converter, feeding 4 separately excited DC motors. Also draw AC side Voltage and current waveform, How problem of Low pf and Harmonic distortion is less acute in this system.  | [5] 01 | 02    |
| Q.3(a) | (i) Draw Equivalent Circuit of Arc Furnace transformer. With neat diagram explain the working of 3Phase Arc Furnace.<br>(ii) With neat diagram explain the working of Induction Furnace.   | [5] 02 | 02    |
| Q.3(b) | A 200 CP Lamp is hung 4 metres above the centre of circular area of 5 metre diameter. Determine illumination (i) at centre of circle(ii) at periphery of circle (iii) average Illumination consider both cases Uniform Intensity distribution and Otherwise (Parallely downward)   | [5] 03 | 03    |
| Q.4(a) | Draw Hardware connection to a PLC and Ladder Diagram that actuates two handed operation with Anti Tie Down and Anti Repeat operation. Take suitable switches required ,connect it to PLC and draw Ladder Diagram.  | [5] 04 | 02    |
| Q.4(b) | A lighting control system is to be developed using PLC wherein four switches Switch-1, Switch-2, Switch-3, Switch-4 control a lamp in such a way that any of three switches-Switch-1, Switch-2, Switch-3, if turned on can turn on the lamp, but all these three must be off before lamp will turn off. The fourth switch is a master control switch. If this switch is in ON position, lamp will be off and none of the other three switches have any control. Draw suitable hardware connection after taking suitable switches to PLC and draw ladder logic for such a lighting system . | [5] 04 | 02    |

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- Q.5(a) Draw the diagram of control circuit and power circuit of a semi automatic star-delta starter for three phase Induction motor having one 'on' and one 'off' push button, such that if you press and continue to press the on push button motor will run in star, if you release on push button motor will switch over to delta and continue to run. With the help of off push button ,motor is turned off. [5] 04 03
- Q.5(b) A big machine with 'ON' and 'OFF' push button is to be operated in following manner-When Operator turns the machine on -first lube pump motor is turned on with one contactor and lubricates the machine, then after a delay of 30 sec main motor is automatically turned on through another contactor. Machine and lube oil is turned off with OFF push button .Draw control and power circuit for this actuation. [5] 04 03

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