Modified

CBCS SCHEME

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15EE742

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020
Utilization of Electrical Power

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. With a neat sketch, explain the construction , working principle of Ajax Wyatt furnace. **(06 Marks)**

b. Explain with a neat sketch, how the spot welding is carried out by a Spot welding machine. **(04 Marks)**

c. A 45 KW , 3 phase , 415V resistance oven employs a nichrome strip of thickness 0.25mm for a 3 – phase star connected heating elements. If the wire temperature is to be 1200^0C and that of the charge to be 800^0C, estimate the length and width of the strip. Assume radiating efficiency of 0.57 and emissivity of 0.9. The specific resistance of nichrome is $1.03 \times 10^{-6}\ \Omega$ – m. **(06 Marks)**

OR

2 a. State Faraday's laws of Electrolysis and explain :
i) Current efficiency ii) Energy efficiency. **(06 Marks)**

b. How much aluminum will be produced from aluminum oxide in 24 hrs if the average current is 3,500A and the current efficiency is 90 percent? Aluminum is Trivalent and its atomic weight is 27. The chemical equivalent of silver is 107.98 and 0.00111gm of silver is deposited by one Coulomb. **(04 Marks)**

c. A circular shaft of a diameter 12cm and 24cm long is to be coated with a layer of 1.6mm nickel. The current density is 200 A/m^2 and current efficiency is 95%. The specific gravity of nickel is 8.9 and its E.C.E is 1.0954 kg per 1,000 Ah. Determine the quantity of electricity required in Ah and time taken for the process in hours. **(06 Marks)**

Module-2

3 a. Two lamp posts are 20m apart and are fitted with lamps of luminous intensity 200 C.P. each at a height of 6m above the ground. Calculate the illumination on the ground i) under each lamp ii) midway between the lamps. **(06 Marks)**

b. Define i) Luminous Flux ii) Luminous intensity iii) Illumination iv) Brightness v) Reduction factor vi) Coefficient of utilization. **(06 Marks)**

c. Explain the working of fluorescent lamp with neat circuit diagram. **(04 Marks)**

OR

4 a. A workshop measuring 30 × 12m is to be provided with an illumination of 100 Lux on the working plane. The coefficient of utilization is 0.4 and the maintenance factor is 0.8 and the luminous efficiency of the lamps is 14 lumens per Watt. Calculate the number of lamps required and their deposition. **(06 Marks)**

b. With a neat figure, explain the construction and working principle of sodium vapour discharge lamp. **(05 Marks)**

c. i) What are the general requirements of factory lighting?
ii) What is flood lighting? **(05 Marks)**

Module-3

5 a. Derive an expression for the specific energy output. **(06 Marks)**

b. An electric train is accelerated from rest to a speed of 60 kmph in 30 seconds. The power is cut off and then the train coasts for 75 seconds against a constant resistance of 50 N/tone and then braked to rest at 4 kmphps in 15 seconds. Calculate the schedule speed, if the duration of station stops is 30 seconds. Allow 10% for rotational inertia. If the stations stop is reduced to 10 seconds , what is the new schedule speed? **(06 Marks)**

c. What are the advantage and disadvantages of Electric Traction? **(04 Marks)**

OR

6 a. Derive an expression for the tractive effort in terms of the weight of the train, acceleration , gradient and train resistance. **(06 Marks)**

b. Define Specific Energy consumption and explain the various factors on which it depends. **(06 Marks)**

c. Explain with the help of suitable circuit diagrams :
i) Shunt transition ii) Bridge transition as applied to a pair of d.c. traction motors. **(04 Marks)**

Module-4

7 a. Describe how plugging , rehostatic breaking and regenerative breaking are employed with d.c motors. **(06 Marks)**

b. Discuss Mechanical breaking arrangements used in electric traction. **(04 Marks)**

c. A 525 – V series traction motor has the following characteristics :

Current (A)	50	70	80	90
Speed (Kmph)	33.8	26.9	25.1	23.8
Torque (N – m)	216	344	422	500

What will be the braking torque at a speed of 26 kmph when operating as a self – excited series generator, the resistance of the braking rheostat being 5.5 ohms and that of the motor being 0.5Ω? **(06 Marks)**

OR

8 a. Show how sag and tension are calculated in trolly wires. **(06 Marks)**

b. Explain the function of a negative booster in a tramway system. **(06 Marks)**

c. Sketch and explain the following arrangements of current collection used in electric traction:
i) Trolley – wire section ii) The bow collector iii) Current collecting shoe
iv) Collector wheel and Trolley - wire. **(04 Marks)**

Module-5

9 a. Explain with neat diagram the concept of series Hybrid Electric Drive trains. **(06 Marks)**

b. Explain General Electric vehicle configuration with block diagram. **(06 Marks)**

c. Explain Traction Motor characteristics of Electric vehicles. **(04 Marks)**

OR

10 a. Explain the concept of energy consumption of Electric vehicles using suitable equations. **(06 Marks)**

b. Explain the concept of Hybrid Electric drive trains. **(04 Marks)**

c. Explain with a neat diagram, the concept of Speed – Coupling Parallel Hybrid Electric Drive trains. **(06 Marks)**

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Sceme and solutions EEE

1 message

Dr. A.Manjunath <manjuprinci@gmail.com>
To: pmanjunath p <pmanjunathvtu@gmail.com>

Sat, Jan 4, 2020 at 10:42 AM

Good Morning
the Scheme and solutions of following subjects are not having any modification and approved from my end
17EE52-Micro controller
15EE72-Power System Protection
15EE73-High Voltage Engineering
15EE742-Utilization of Electric power

Dr.A.Manjunath
Chairman BOE, EEE

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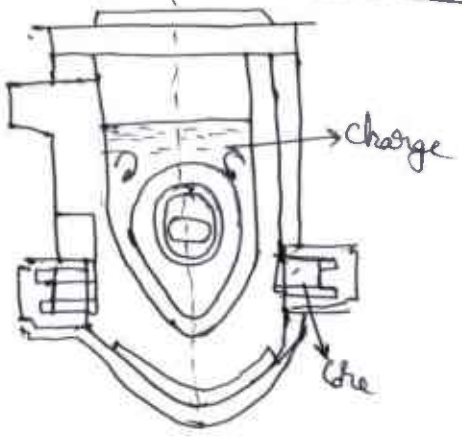
Signature of Scrutinizer

Scheme & Solution

Subject Title: Utilization of Electrical Power **Subject Code:** 15EE742

Question Number	Solution	Marks Allocated
1) a)	Diagram → (02 marks) Explanation → (04 marks) 	06 marks
b)	Diagram → (02 marks) Explanation → (02 marks)	04 marks
c)	$P_{ph} = \frac{45}{3} = 15\,kW$ → (01 mark); $V_{ph} = \frac{415}{\sqrt{3}} = 239.6\,V$ $R = \frac{V^2}{P} = 5.29\,\Omega$ → (01 mark) $H = 99,244.91\ W/m^2$ → (01 mark) Width = 0.00767 m or 7.67 mm → (02 marks) Length = 29.55 m → (01 mark)	06 marks
2) a)	Statement of Faraday's First Law → 01 mark Statement of Faraday's Second law → 01 mark Explanation of Current Efficiency → 02 marks Explanation of Energy Efficiency → 02 marks	06 marks

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Question Number	Solution	Marks Allocated
2) b)	Chemical Equivalent of aluminium = $\frac{\text{atomic weight}}{\text{Valency}} = \frac{27}{3} = 9$ → (01 mark)	04 marks
	ECE of aluminium = $\frac{0.00111}{107.98} \times 9$ gm Per Coulomb → (01 mark)	
	∴ weight of aluminium = 25.4 kg → (02 mark)	
c)	Surface area of Shaft = $\pi D l = 0.09048\ m^2$ → (01 mark)	06 marks
	Mass of nickel deposited = 1.2884 kg → (01 mark)	
	$Q = \frac{m}{z} = \frac{1.2884}{\frac{1.0954}{1000}} = 1,176.19$ Ah → (01 mark)	
	Actual Quantity required = $\Phi = \frac{1176.19}{0.95} = 1,238.095$ Ah (01 mark)	
	I = 18.096 A → (01 mark)	
	Time required = $\frac{1238.095}{18.096} = 68.42$ hours (01 mark)	
3) a)	$d_1 = 11.66$m, $\cos\theta_1 = \frac{6}{11.66}$ (01 mark) $d_2 = 20.88$m, $\cos\theta_2 = \frac{6}{20.88}$ (01 mark)	06 marks
	E_1 = Illumination under Each Lamp = 5.688 Lux → (02 marks)	
	Illumination midway between the Lamps = 1.514 Lux → (02 marks)	
b)	Each defination Carry 01 mark → 01 × 6	06 marks
c)	Circuit diagram → (02 marks) Explanation → (02 marks)	04 marks
4) a)	Total Flux (ϕ) = 1,12,500 Lumens → (01 mark) Let use 200 W lamps	06 marks
	Lumen output of Each lamp = 200 × 14 = 2800 Lumens → (01 mark)	
	No of lamp ≃ 40 Lamps (02 marks) Positioning of lamps 4 → Rows (02 marks) 10 → Columns	

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Question Number	Solution	Marks Allocated
4) b)	Diagram → (02 marks) Explanation → (03 marks)	05 marks
c)	Each requirement point of factory lighting carry 01 mark 01 × 3 → 03 mark Explanation of Flood lighting → 02 mark	05 marks
5) a)	Derivation of Specific Energy output. $E_1 = \frac{1}{2} \times \frac{f_t V_m}{3600} \times t_1$ → (01 mark) ; $E_2 = (98.1WG + W\gamma)\frac{D}{3600}$ → (01) $\therefore E = 0.01072 W_e V_m^2 + 0.2778 (98.1WG + W\gamma) D_1$ → (01 mark) Specific Energy output = $\frac{0.01072 V_m^2}{D}\frac{W_e}{W} + 27.25 G \frac{D_1}{D} + 0.2778\gamma\frac{D_1}{D}$ / $\eta_g \eta_m$ → (03 marks)	06 marks
b)	α = 2 Kmphps β_c = 0.164 Kmphps } (01 mark) V_2 = 47.7 Kmph → (01 mark) D = 1.472 Km → (01 mark) Schedule Speed (V_s) = 35.328 Kmph → (02 marks) New Schedule Speed = 40.76 Kmph → (01 mark)	06 marks
c)	Advantages of Electric traction → (02 marks) Disadvantages of Electric traction → (02 marks)	04 marks
6) a)	Derivation $F_a = 277.8 W\alpha$ → (01 mark) $F_g = 98.1 WG$ newtons → (01 mark) $F_r = W\gamma$ → (01 mark) $\therefore F_t = 277.8 W_e \alpha \pm 98.1 WG + W\gamma$ → (03 marks)	06 marks
b)	Defination → (01 marks) Factors affecting S.E.C. i) Maximum Speed ii) Efficiency of gear & motors → (01 mark) iii) Distance → (01 mark) iv) Acceleration → (01 mark) v) Gradient & resistance → (01 mark)	06 marks
c)	i) Shunt transition Diagram → (01) Explanation (01 mark) ii) Bridge transition Diagram → (01) Explanation (01 mark)	04 marks

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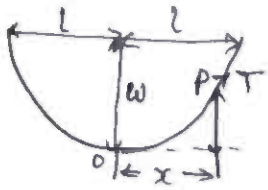
Question Number	Solution	Marks Allocated
7) a)	Explanation of plugging → (01 mark) Explanation of rehostatic breaking ; Diagram → (01 mark) ↳ (01 mark) Explanation of regenerative breaking → (01 mark) ; Diagram (02 mark)	06 marks
b)	Explanation of i) Vaccum Brake (02 marks) ii) Compressed Air Brake (02 marks)	04 marks
c)	Graph representation → (02 marks) E_b = 487.5 Volts → (01 mark) I = 81.25 A → (01 mark) Torque = 430 N-m → (02 marks)	06 marks
8) a)	 → (01 mark) Derivation → (05 marks) $S = x + \frac{1}{6}\frac{w^2}{T^2}x^3 - \ldots$ Length of Conductor in half the Span = $l + \frac{2}{3}\frac{d^2}{l}$	06 marks
b)	Diagram → (02 marks) Explanation → (04 marks)	06 marks
c)	Explanation of Each term with diagram Carry 01 mark 01 x 4 : 04 marks	04 marks
9) a)	Diagram → (02 marks) Explanation → (04 marks)	06 marks
b)	Block diagram → 02 marks Explanation → 04 marks	06 marks

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Question Number	Solution	Marks Allocated
c)	Explanation → 03 ~~Coupled~~ characteristics (curves) → 01	04 marks
10) a)	Explanation → (04 marks) Equation $P_{b\text{-}out} = \frac{V}{\eta_t \eta_m}\left(M_v g(f_r+i) + \frac{1}{2}\rho_a C_D A_f V^2 + M\delta\frac{dv}{dt}\right)$ → (01 mark) $E_{out} = \int_{traction} P_{b\text{-}out}\,dt + \int_{breaking} P_{b\text{-}in}\,dt$. $P_{b\text{-}in} = \frac{\alpha V}{\eta_t \eta_m}\left(M_v g(f_r+i) + \frac{1}{2}\rho_a C_D A_f V^2 + M\delta\frac{dv}{dt}\right)$ → (01 mark)	06 marks
b)	Block diagram → (02 marks) Explanation → (02 marks)	04 marks
c)	Diagram of Speed-Coupling → (02 marks) Explanation → (04 marks)	06 marks

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