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TANTA UNIVERSITY
FACULTY of ENGINEERING
DEPARTMENT OF ELECTRICAL POWER AND MACHINES ENGINEERING
EXAMINATION (2ND YEAR) STUDENTS OF ELECTRICAL POWER AND MACHINES ENG.

COURSE TITLE: POWER ELECTRONICS (1)			**COURSE CODE: EPM2209**
DATE: 8 /6/2016	**TERM: SECOND TERM**	**TOTAL ASSESSMENT MARKS: 75**	**TIME ALLOWED: 3 HOURS**

Notes: Any data not given is to be assumed – Answer ALL the following questions

The first question (22 marks)	
A	Compare between general purpose diode and fast recovery diode from the following faces: frequency range, recovery time, cost, voltage and current rating and their applications. **(5 marks)**
B	A single-phase center-tapped rectifier is used to charge a battery of 24 V and 120 W-H. If the supply voltage with 220 V is used to feed the full-wave rectifier with 1:1 rectifier transformer, find (a) the diode conduction angle; (b) the value of current limiting resistor for 10 A (DC current) flows through battery; (c) the charging time in hours; (d) the power loss through the current limiting resistor; (e) the circuit efficiency. **(10 marks)**
C	A single-phase bridge rectifier is fed from 220 V supply. If the load current is continuous with ripple free current of Ia, using Fourier analysis to evaluate. (a) The input power factor by different two methods; (b) harmonic factor of input current; (c) the transformer utilization factor. **(7 marks)**
The second question (15 marks)	
A	For three phase bridge rectifier with highly inductive load, Derive an expression for reduction of output voltage, commutation angle and phase current during transition from D1 to D3. **(5 marks)**
B	Three-phase full-wave rectifier is supplied from star connected supply with phase voltage of 127 V, 50 Hz. The load current is 60 A and a negligible ripple. Determine the following: (a) the reduction of output voltage due to commutation if the source inductance per phase is 0.5 mH, (b) the average value of output voltage; (c) the rms value of output voltage; (d) the average and rms of diode current; (e) the input power factor; (f) the transformer utilization factor; (g) the PIV of diodes; (h) plot all waveforms required. **(10 marks)**
The third question (19 marks)	
A	Sketch the static and dynamic characteristics of a thyristor, and then define the delay and rise time. **(6 marks)**
B	Single phase series full converter is connected to feed a resistive load of 30 ohm. The supply voltage is 220 V and N_p: N_s = 2:1. If the average output voltage is 70 % of the maximum possible average output voltage, calculate: (a) the delay angles of the converters; (b) the rms and average load voltage; (c) the rms and average SCR currents; (d) the input power factor and TUF. **(13 marks)**
The fourth question (19 marks)	
A	Discuss briefly the methods used to improve the system input power factor? **(6 marks)**
B	A three phase semi-converter is operated from three-phase Y-connected 380V, 50 Hz supply and used to feed a highly inductive load with 10 ohm resistor. If it is required to obtain an output power of 20 kW, calculate: (a) the converter delay angle; (b) rms and average output currents; (c) the average and rms SCR currents; (d) Rectifier efficiency, transformer utilization factor and input power factor. **(13 marks)**

Good Luck and best wishes

Dr. Abdelwahab Hassan Dr. Hosam A. Saleh

Tanta University		Department: Electrical Power and Machine Engineering		Faculty of Engineering
Course Title:Mechanical Power Station			Course Code: MEP2242	2th year
Date: 11– 6– 2016		Allowed time: 3hrFull Marks: (50)		No of Pages:1
Name: Prof. Dr. A. E. kabeel				Final Exam

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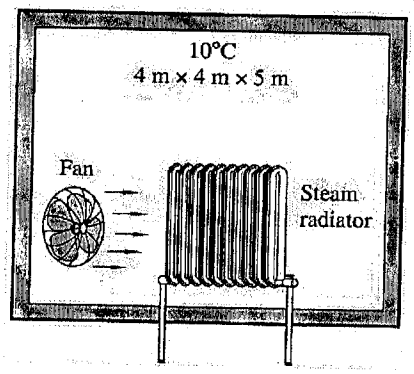
Answer the following questions: Assume any necessary assumptions. **Marks**

Question No. 1 (10)

a) What the difference between:

- Intensive and extensive properties.
- Critical and triple point.
- Open and closed system.

b) A well-insulated 4 m * 4 m * 5 m room initially at 10°C is heated by the radiator of a steam heating system. The radiator has a volume of 15 L and is filled with superheated vapor at 200 kPa and 200°C. At this moment both the inlet and the exit valves to the radiator are closed. A 1.20 kJ fan is used to distribute the air in the room. The pressure of the steam is observed to drop to 100 kPa after 30 min as a result of heat transfer to the room. Determine the change in internal energy of air in 30 min. Assume the air pressure in the room remains constant at 100 kPa.



Question No. 2 (10)

a) How to increase the Brayton cycle efficiency.

b) A well-insulated rigid tank contains 5 kg of asaturated liquid–vapor mixture of water at 100 kPa. Initially,three-quarters of the mass is in the liquid phase. An electricresistor placed in the tank is connected to a 110-V sourceand a current of 8 A flows through

the resistor when theswitch is turned on. Determine how long it will take to vaporize all the liquid in the tank. Also, show the process on a T-V and P-V diagrams with respect to saturation lines.

Question No. 3 (8)

a) For diesel cycle prove that:

$$\eta_{diesel} = 1 - \left(\frac{1}{r}\right)^{(\gamma-1)} \left(\frac{r_c{}^{\gamma} - 1}{\gamma(r_c - 1)}\right)$$

b) An air-standard Diesel cycle has a compression ratio of 16 and a cutoff ratio of 2. At the beginning of the compression process, air is at 95 kPa and 27°C. Accounting for the variation of specific heats with temperature, determine (a) the temperature after the heat-addition process, (b) thethermal efficiency, and (c) the mean effective pressure.

Question No. 4 (10)

Consider an ideal gas-turbine cycle with two stages ofcompression and two stages of expansion. The pressure ratio across each stage of the compressor and turbine is 3. The air enters each stage of the compressor at 300K and each stage of the turbine at 1200K. Determine the backwork ratio and the thermal efficiency of the cycle,assuming (a) no regenerator is used and (b) a regenerator with 75percent effectiveness is used.

Question No. 5 (12)

A steam power plant operates on an ideal regenerativeRankine cycle with two open feedwater heaters. Steam enters the turbine at 10MPa and 600°C and exhausts tothe condenser at 5kPa. Steam is extracted from the turbine at 0.6 and 0.2MPa. Water leaves both feedwater heaters as a saturated liquid. The mass flow rate of steam through the boiler is 22kg/s. Show the cycle on a T-s diagram, and determine the net power output of the power plant and (b) the thermal efficiency of the cycle.

Good luck

Prof. Dr. A. E. kabeel