

**III B. Tech II Semester Regular Examinations, April - 2016**  
**REFRIGERATION AND AIR CONDITIONING**  
**(Mechanical Engineering)**

Time: 3 hours

Maximum Marks: 70

- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)  
 2. Answering the question in **Part-A** is compulsory  
 3. Answer any **THREE** Questions from **Part-B**

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**PART -A**

1. a) Explain the term ``Tonne of refrigeration``. [4M]
- b) Why in practice a throttle valve is used in vapour compression refrigerator rather than an expansion cylinder to reduce pressure between the condenser and the evaporator? [4M]
- c) `` A completely odourless refrigerant is not desirable``, discuss the statement. [3M]
- d) Discuss the function of absorber in vapour absorption refrigeration system. [3M]
- e) What is the difference between wet bulb temperature and thermodynamic wet bulb temperature? [4M]
- f) Explain the features required for the proper selection of a fan for a given application? [4M]

**PART -B**

2. a) Draw the schematic of a boot-strap cycle of air refrigeration system, and show the cycle on T-s diagram. [6M]
- b) In a boot-strap refrigeration system for an aircraft the ambient conditions are 0.225 bar and  $-50^{\circ}\text{C}$ . Cooling load estimate is 20 ton refrigeration (20 TR). The speed of the plane is 1000 km/hr. Ram efficiency is 0.9. the pressure ratio for the main compressor is 3.5 and this bled off air is further compressed in secondary compressor run by cooling air turbine on a single shaft such that output from turbine is equal to input to the compressor. The internal efficiency of main compressor as well as secondary compressor is 0.9, and that of cooling turbine is 0.8. The air from secondary compressor is cooled by ram air to  $50^{\circ}\text{C}$ . The cooling air turbine running the secondary compressor has its exit pressure of 1 bar. Determine (i) Delivery pressure from the secondary compressor, (ii) Mass flow rate bled for cooling the cabin, (iii) COP of the system. [10M]
3. a) Discuss the effect of sub-cooling on COP. Would you desire large sub-cooling and why? [6M]
- b) A refrigerating plant using  $\text{CO}_2$  as refrigerant works between  $25^{\circ}\text{C}$  and  $-5^{\circ}\text{C}$ . The dryness fraction of  $\text{CO}_2$  is 0.6 at the entry of the compressor. Find the ice formed per day if the ice is formed at  $0^{\circ}\text{C}$  and from the water at  $10^{\circ}\text{C}$ . Quantity of  $\text{CO}_2$  circulated=10 kg/min. Take relative efficiency=0.6. Take  $C_p$  (water) = 4.2 kJ/kg, latent heat of ice=335kJ/kg. [10M]

Temperature $^{\circ}\text{C}$	Liquid heat (kJ/kg)	Latent heat (kJ/kg)	Entropy of liquid (kJ/kg K)
25	81.25	121.6	0.2513
-5	-7.53	245.8	-0.0419

4. a) Describe the working of an evaporative condenser. [7M]
- b) Explain the working of following types of evaporators with neat sketches: (i) Shell and tube evaporator, (ii) Forced convection evaporator, (iii) Shell and coil evaporator. [9M]



5. a) Draw a neat diagram of lithium bromide water absorption system and explain its working in major field of applications of this system. [8M]
- b) Derive an expression for the COP of an ideal vapour absorption system in terms of temperature  $T_G$  at which heat is supplied to the generator, the temperature  $T_E$  at which heat is absorbed in the evaporator and the temperature  $T_C$  at which heat is discharged from the condenser and absorber. [8M]
6. a) Explain the difference between comfort air-conditioning and industrial air-conditioning. [8M]
- b) Define the term `` effective temperature `` and explain its importance in air-conditioning system. Describe the factors which affect effective temperature. [8M]
7. a) Describe a centrifugal fan with the help of a neat sketch? [8M]
- b) Explain in detail about heat pump circuits? [8M]

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**PART -A**

1. a) Discuss the advantages of the dense air refrigerating system over an open air refrigeration system. [3M]
- b) Under what circumstances the superheating of vapour before coming to compressor is more objectionable? Give the ways to prevent it. [4M]
- c) Discuss why refrigerants are so selected that evaporator pressures and condenser pressure are greater than atmospheric pressure. [4M]
- d) Discuss the advantages of vapour absorption refrigeration system over vapour compression refrigeration system. [4M]
- e) Prove that the partial pressure of water vapour in the atmospheric air remains constant as long as the specific humidity remains constant. [4M]
- f) What is the function of a fan in an air conditioning system? [3M]

**PART -B**

2. a) Draw the schematic of a boot-strap evaporative cycle of air refrigeration system, and show the cycle on T-s diagram. [6M]
- b) A regenerative air refrigeration system for an air plane has to take 30 ton of load, while the ambient conditions are 0.80 bar and 7<sup>0</sup>C. The ramming action leads to a pressure rise from 0.8 bar to 1.2 bar at constant entropy. The air is bled off the main compressor at 4.8 bar. The ram air heat exchanger is 60% effective. The air from the heat exchanger passes on to cooling turbine. Some portion of the air after expanding in the cooling turbine passes on to the regenerative heat exchanger reducing the temperature of the main compressed air to 50<sup>0</sup>C. The cooling air from turbine gets heated to 100<sup>0</sup>C before discharging. The isentropic efficiencies of the compressor and the turbine are 90% and 80% respectively. The cabin is pressurized to 1 bar and maintained at 25<sup>0</sup>C. Determine (i) The ratio of the air extracted from cooling turbine for regenerative cooling of the ram air, (ii) Power required for maintaining the cabin at required condition. Assume the cooling turbine power developed to be used for ram air exhaust fan. [10M]
3. a) How does the increase in condenser temperature affect COP? Also explain the influence of evaporator temperature on COP. Which of the two temperatures have more influence on COP? [6M]
- b) A refrigerating plant of 28 kW capacity has its evaporation temperature -8<sup>0</sup>C and condenser temperature of 30<sup>0</sup>C. The refrigerant, R-12 is sub-cooled 5<sup>0</sup>C before entering the expansion valve and the vapour is superheated 6<sup>0</sup>C before leaving the evaporator coil. The compression of the refrigerant in the compressor is isentropic. If there is a suction pressure drop of 0.2 bar through the valves; and discharge pressure drop through the valve of 0.1 bar, determine the C.O.P. of the plant, theoretical piston displacements/min and the heat removed in the condenser. Solve the problem with the help of P-h chart. Give also a diagrammatic sketch of this cycle on the T-s chart. [10M]

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4. a) Discuss the natural and forced convection types of air-cooled condensers. [8M]  
b) Discuss the operation of a capillary tube in a refrigeration system. [8M]
5. a) Draw a neat diagram of three-fluid system of refrigeration (Electrolux refrigeration system) and explain its working. [8M]  
b) List out the merits and demerits of thermo-electric refrigeration system over other refrigeration system. What are the fields of its applications? [8M]
6. a) Define room sensible heat factor. How room sensible heat factor line is drawn on the psychrometric chart? [8M]  
b) Explain in brief as to how the human body reacts to changes in temperature of environment. Also explain the effect of activities on the heat load calculation for comfort application. [8M]
7. a) Explain the various types of axial flow fans. [8M]  
b) Explain the case of heat pump for heating and cooling cycle with neat diagram. [8M]

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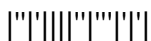
**PART -A**

1. a) `` The COP of an air refrigeration cycle is very low, but still a refrigeration system is most common in the Air craft `` , discuss the statement. [3M]
- b) Mention the advantages of vapour compression refrigeration system over air refrigeration system. [3M]
- c) What are essential properties of a good refrigerant? [3M]
- d) Define and write the expression for nozzle efficiency in steam jet refrigeration system. [3M]
- e) Define the term `bypass` factor used for cooling or heating coil and find the expression for that. [5M]
- f) Make the arrangement of heat pump when it is used for year round air conditioning. [5M]

**PART -B**

2. a) Explain the difference between simple air craft refrigeration and boot-strap air refrigeration system. [6M]
- b) An air refrigerator working on Bell-Coleman cycle takes air into the compressor at 1 bar and 268 K. It is compressed in a compressor to 5 bar and cooled to 298 K at the same pressure. It is further expanded in the expander to 1 bar and discharged to take the cooling load. The isentropic efficiencies of the compressor and expander are 85% and 90% respectively. Determine : (i) Refrigeration capacity of the system if the air circulated is 40 kg/ min; (ii) Power required for the compressor; and (iii) C.O.P of the system. [10M]
3. a) Draw the vapour compression refrigeration cycle on T-s diagram when the refrigerant is dry and saturated at the end of compression and find an expression for the C.O.P in terms of (i) Temperature and entropies; (ii) Enthalpy. [8M]
- b) A vapour compression refrigerator uses R-12 as refrigerant and the liquid evaporates in the evaporator at  $-15^{\circ}\text{C}$ . The temperature of this refrigerant at the delivery from the compressor is  $15^{\circ}\text{C}$  when the vapour is condensed at  $10^{\circ}\text{C}$ . Find the coefficient of performance if the liquid is cooled by  $5^{\circ}\text{C}$  before expansion by throttling. Take specific heat at constant pressure for the superheated vapour as  $0.64\text{kJ/kg K}$  and that for liquid as  $0.94\text{ kJ/kg K}$ . the other properties of refrigerant are as follows: [8M]

Temperature in $^{\circ}\text{C}$	Enthalpy in kJ/kg		Specific entropy in kJ/kg K	
	liquid	vapour	liquid	vapour
-15	22.3	180.88	0.0904	0.7051
10	45.4	191.76	0.1750	0.6921



4. a) Write short notes on (i) Ozone layer depletion; (ii) Global warming. [8M]  
b) Explain the working principle of thermostatic expansion valve with the help of a neat diagram. [8M]
5. a) Derive an expression for finding out the mass of motive steam required per kg of water vapour produced. [8M]  
b) Explain the working principle of vortex tube and explain that the energy exchange phenomenon in vortex tube is not a violation of second law of thermodynamics. [8M]
6. a) Explain the procedure to draw a grand sensible heat factor line on a psychrometric chart. What do you understand by effective room sensible heat factor? [8M]  
b) Why ventilation is required? Explain why different ventilation standards for different purposes are recommended? [8M]
7. a) Give the classification of fans and explain the working principles on which they work. [8M]  
b) Suggest the different constructional features used in heat pump to improve the overall EPR. [8M]

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**PART -A**

1. a) What is the need of air conditioning of air-crafts at high altitudes where ambient temperatures are very low. [4M]
- b) Distinguish between dry and wet compression. What are the advantages at one over the other? [3M]
- c) What are the desirable properties of an ideal refrigerant? [3M]
- d) Define and write the expression for entrainment efficiency in steam jet refrigeration system. [4M]
- e) With the help of psychrometric chart explain the following process and give the important characteristic features of adiabatic cooling and humidification process. [4M]
- f) Give the classification of fans. [4M]

**PART -B**

2. a) Explain refrigeration system using Brayton cycle and show the state points on Temperature-Entropy diagram considering the irreversibilities. [8M]
- b) A dense air refrigeration machine operating on Bell-Coleman cycle operates between 3.4 bar and 17 bar. The temperature of air after the cooler is 15°C and after the refrigerator is 6°C. For a refrigeration capacity of 6 tonnes, find: (i) Temperature after compression and expansion, (ii) Air circulation required in the cycle per minute, (iii) Work of compressor and expander, (iv) Theoretical C.O.P and (v) Rate of water circulation required in the cooler in kg/min, if the rise in temperature is limited to 30°C. [8M]
3. a) How does an actual vapour compression cycle differ from that of a theoretical cycle? [6M]
- b) A vapour compression refrigeration machine, with Freon-12 as refrigerant, has a capacity of 12 tonne of refrigeration operating between -28°C and 26°C. The refrigerant is sub-cooled by 4°C before entering the expansion valve and the vapour is superheated by 5°C before leaving the evaporator. The machine has a six-cylinder single-acting compressor with stroke equal to 1.25 times the bore. It has a clearance of 3% of the stroke volume. Determine (i) Theoretical power required, (ii) C.O.P, (iii) Volumetric efficiency, (iv) Bore and stroke of cylinder. The speed of compressor is 1000 r.p.m. the following properties of Freon-12 may be used: [10M]

Sat. temperature °C	Pressure bar	Sp. Volume of vapour, m <sup>3</sup> /kg	Enthalpy, kJ/kg		Entropy, kJ/kg K	
			liquid	vapour	liquid	vapour
-28	1.093	0.1475	10.64	175.11	0.0444	0.7153
26	6.697	0.0262	60.67	198.11	0.2271	0.6865

Specific heat of liquid refrigerant=0.963 kJ/kg K and specific heat of superheated vapour=0.615 kJ/kg K.



4. a) Write short notes on the types of refrigeration compressors. [8M]  
b) Explain the working of following types of evaporators with neat sketches: [8M]  
(i) Flooded evaporator, (ii) Natural convection evaporator.
5. a) Explain with the help of a neat sketch, the working of a steam jet refrigeration system. [8M]  
b) Explain the working principle of thermo-electric refrigeration system. Compare the [8M]  
working of different components of thermo-electric refrigeration system with the working  
of different components of vapour compression system.
6. a) Explain the concept of effective sensible heat factor for room to be air conditioned. How is [8M]  
it useful to find the ADP for fixed room design condition?  
b) Define the `` human comfort `` and explain the factors which affect human comfort. [8M]
7. a) Explain the use of HEAT PUMP for heating and cooling cycle with neat diagram. [8M]  
b) Explain in detail different components of fans? [8M]

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**III B. Tech II Semester Regular Examinations, April-2016**  
**INTELLECTUAL PROPERTY RIGHTS AND PATENTS**  
 (Common to CSE, IT, Chem E and PE)

Time: 3 hours

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**PART -A**

- 1 a) Internet poses new challenges to copyright protection in the digital era. Explain the statement. [4M]
- b) Service Marks are also protected under the Intellectual Property Law. Identify the law that protects service marks and state the importance of service marks. [4M]
- c) What is digital signature and explain its purpose? [3M]
- d) Canon Digital Camera has come up with a new model in 2015 October and they want to protect this new invention of their company in India. Which law protects this invention? [4M]
- e) Coca-Cola formula and its IPR protection. [3M]
- f) World Intellectual Property Organization and its functions. [4M]

**PART -B**

- 2 a) What do you mean by Intellectual Property Rights? [4M]
- b) State the value of Intellectual Property Rights in the present days. Why and what value does intellectual property create for the companies? [4M]
- c) What are the different kinds of Intellectual Property Rights? Give example for each one of them. [8M]
- 3 a) 'X' company uses a mark which is very similar to the Trade Marks of 'Y' company and starts selling its products successfully. The revenue of the 'Y' company has also decreased. What can 'Y' company do? State the remedy/ies that 'Y' company can get from 'X' company. [8M]
- b) What do you mean by Trade Mark/s? State the IP law relating to Trade Marks and describe its nature. [8M]
- 4 a) What are the requirements to be fulfilled to grant a Patent? State the process from patent search till the grant of patent. [8M]
- b) Distinguish between Patent Protection and Trade Secrets. Give examples and explain each of these Intellectual property rights and its infringements. [8M]
- 5 a) Explain the subject matter of copyrights with the help of examples. Are Collective work and Derivative work also copyrightable? [8M]
- b) The owner of the copyright can own the copyright even without registration. Can an owner transfer his copyrights to others? Explain with examples. [8M]



- 6 a) Semiconductor Chip Protection law is made against the chip Piracy. Reverse Engineering is one of the best methods used for infringements. Discuss. [4M]
- b) How is India developing its Intellectual Property Laws to comply with the International Standards? State the International aspects of IPR laws and the agencies responsible for their protection. [8M]
- c) Explain the methods of protecting Trade Secrets. [4M]
- 7 a) E-commerce transactions are protected under Information Technology Act, 2000 (IT Act). Explain the benefits of e-commerce and e-governance. [8M]
- b) Data security is a challenging task for the individuals, companies and government. The large amount of data collection is a risk to protect privacy and confidentiality. Discuss the penalties, compensations and offences under IT Act 2000. [8M]

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**PART -A**

- 1 a) Which law protects movies and its related rights? Identify and explain the importance of this Law. [4M]
- b) Fish medicine given by one of the well known Family in India is also protected under the Intellectual Property Rights. Identify the law and explain its nature. [3M]
- c) A chemical is invented by a group of researchers. This is a new chemical that can be used for manufacturing fertilizer. What kind of an intellectual property can protect this invention? [4M]
- d) Which law protects the logo/s of companies? Identity the law with examples. [4M]
- e) Write a short note on Trade- Related Aspects of Intellectual Property Rights (TRIPS). [4M]
- f) Explain the Virus Attack on Computers. [3M]

**PART -B**

- 2 a) State the meaning of originality and fixation in copyright law with all the categories of works that are protected. Explain with examples as to why an Idea cannot be copyrighted? [6M]
- b) When do copyrighted work come to the public domain and allowed to be used by public? [4M]
- c) What are the rights and remedies available to the copyright holder/owner? Write the meaning of Fair Dealing. [6M]
- 3 a) State the essentials to be fulfilled to get a patent for a product. [4M]
- b) Give an overview of Patent Act, 1970 and state as to how it protects the Patentee. [8M]
- c) In some countries Software Programs are Copyrighted and in few it is Patented. Describe. [4M]
- 4 a) Trade Marks law not only protects the trademarks of companies but also protects the interest of consumers. Comment and explain the purpose of Trademark law. [6M]
- b) Trade Marks are registered and an infringement of registered trademark is a civil wrong as well as an offence. Discuss as to how they can be infringed with special reference to passing- off as a remedy. [6M]
- c) Collective Trade Mark, Well Known Trademarks and Certification Mark are protected under the Trade Marks law. Elucidate with illustrations. [4M]



- 5 a) New types of crimes are taking place in cyberspace. The use of internet leads to increase in cybercrimes. Which law in India treats various crimes as cyber crimes? [4M]
- b) State the e-governance initiatives taken up by India with special reference to State of Andhra Pradesh with the help of examples. [6M]
- c) Online buying and selling of goods and services can help economic development. Give examples of online commerce and state its advantages and disadvantages. Explain as to how the Information Technology Act, 2000 facilitates e-commerce. [6M]
- 6 a) Which are the International Agencies that are facilitating the development of Intellectual Property laws? [8M]
- b) Every Intellectual Property right aim at protecting different rights of the owner/proprietor of IP right. State all the types of IPR's with examples and the related laws in India. [8M]
- 7 a) What are Trade Secrets? Give Examples. [4M]
- b) What are the methods to protect the trade secrets? [6M]
- c) Distinguish between Trade Secrets and Patent Protection. [6M]

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(Common to CSE, IT, Chem E and PE)

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**PART -A**

- 1 a) A group of people are using a plant extract to produce a homemade preparation that gives immunity to human body and also enhancing energy. However, these raw materials and the temperature for the growing of these trees are available only in the region of Andhra Pradesh (Tribal Area) and well known throughout the world. Which IPR can protect the groups of people of the region for making it and prevent other people from making the same? [3M]
- b) State the objectives of enacting Information Technology Law in India. [4M]
- c) Motor Car Design that has ascetic looks or appearance is protected under which of the Intellectual Property Rights. Explain. [4M]
- d) Your friend wrote a book on C++. What Intellectual property would protect his authorship? Can you also write a book on the same subject i.e. C++ and get protection under this law? Discuss the protection given under law to the authors of books. [4M]
- e) Domain name is also a Trade Mark. Is the statement true? [4M]
- f) What is Patent Cooperation Treaty (PCT)? How is it helpful to the patent applicants? [3M]

**PART -B**

- 2 a) What do you understand by Patent? State the features to be proved to get a patent. State the specifications that are to be submitted to the Patent office. [8M]
- b) The state/government can grant compulsory licenses for patents in order to protect the interest of the society. Is it true? Explain [8M]
- 3 a) Artistic Work, Music and Literary works are protected under copyright law. Explain with examples. [4M]
- b) Explain the meaning of copyright. Are performers' rights also protected? [4M]
- c) State the various rights, infringements and remedies as per the Copyright Law? [8M]
- 4 a) Information Technology Law was made to facilitate E-commerce and E-governance in India. Discuss as to how the law helps in making e-contracts/online contracts as valid. [6M]
- b) Electronic signature helps in doing globalised trade. How does the Information Technology Act, 2000 facilitate registration of Electronic Signature. [4M]
- c) There are various wrongs that are committed through the use of internet and computer. These are civil wrongs and offences (popularly known as cybercrimes). Explain with examples. [6M]



- 5 a) What are Trade Marks and Service Marks? Write a short note on the importance of Trade Marks Law and its benefits to conduct business. [8M]
- b) What do you mean by likelihood of confusion? State the rights and remedies available to the Trade Marks proprietor and the assignee. [8M]
- 6 a) Misuse/violations of Intellectual Property Rights are increasing. Comment on various IPR's and their violations with special reference to violations in the digital era. [8M]
- b) Intellectual Property is valued more than the buildings and other properties of the companies. State the importance of IPR's in the globalised world. State the influence of International law changes on National law. [8M]
- 7 a) Explain as to why some companies prefer to maintain Trade Secrets than register a Patent. State the meaning and importance of these two IPR's. [8M]
- b) Non-disclosure agreements and intention to maintain confidentiality is an important element to protect Trade Secrets. Comment on the statement. [8M]

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**PART -A**

- 1 a) What are meant by Copyright and Assignment of Copyright? [4M]  
b) What are Trade Secrets? How they can be maintained. [4M]  
c) Word “airtel”/“idea” by the mobile company/ies to identify their services are protected by one of the Intellectual Property Law. Identify the law and give a brief note of this IP Law with other examples. [4M]  
d) What is World Trade Organization and explain its role. [3M]  
e) Write a note on Data Security in cyberspace. [4M]  
f) Write about patent search and its purpose. [3M]

**PART -B**

- 2 a) Trade secrets protection is very difficult. Comment with special reference to Non-disclosure agreements between employer and employee. [6M]  
b) Neem and Basmati Rice story of India is an example of Geographical Indication. State the examples and give an overview of this IP Right and its protection in India. [4M]  
c) Write about Reverse Engineering and Chip Piracy. Which Law provides protection against Chip Piracy? [6M]
- 3 a) In India both product and process patent are granted. Analyze. [4M]  
b) What is the meaning of patent search and patent infringement? State the process of filling an application for registration of patent, raise objections and grant of patent. [8M]  
c) Compulsory License can be issued for the benefit of people. When is a Compulsory License issued and revoked? [4M]
- 4 a) International Treaties and Conventions are the guiding principles to make Intellectual Property Laws for all the countries. India is a member of various conventions and it is constantly changing its laws as per the global requirements. Explain with the help of conventions and treaties related to IPR's. [8M]  
b) What do you understand by Intellectual Property Right? There are varied types of Intellectual Property Rights. Some are protected through laws and others are by practice. Explain with examples. [8M]



- 5 a) E-contracts are also good (valid) contracts as per the Information Technology Act, 2000. E-contracts help the growth of e-commerce and e-governance. Discuss with examples. [8M]
- b) Cyber Crimes are hindrance to the growth of online/electronic transactions. What are the different types of cyber crimes? [8M]
- 6 a) State the works in which copyright subsists. When copyrights are said to be infringed? Certain acts are still not considered to be copyright infringement. Identify them with special reference to Fair Dealing. [8M]
- b) Explain the Broadcasting and Performers' Rights. What are civil remedies available under the Copyright Law in India? [8M]
- 7 a) What is Trade Mark law and what are the marks covered under the Trade Mark Law – 1999? [8M]
- b) Write about Trade Mark claims in matters of deceptive similarities of Trade Marks. [8M]

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