19th NATIONAL CERTIFICATION EXAMINATION
FOR
ENERGY MANAGERS & ENERGY AUDITORS – SEPTEMBER, 2018

PAPER – 2: ENERGY EFFICIENCY IN THERMAL UTILITIES

Section – I: OBJECTIVE TYPE **Marks: 50 x 1 = 50**

(i) Answer all **50** questions
(ii) Each question carries **One** mark
(iii) Please hatch the appropriate oval in the OMR answer sheet with **HB pencil only,** as per instructions

1. Density of liquid fuel is measured by an instrument called
   a) Anemometer
   b) Hydrometer
   c) Luxmeter
   d) All the above

2. The measured O_2 in flue gas is 5.5 % by volume, the excess air percentage will be
   a) 41 %
   b) 55.9 %
   c) 35.5 %
   d) None of the above

3. The efficiency of a reheating furnace, operating at 10 tonnes per hour consuming furnace oil of 230 kg/hour for reheating the material from 40 °C to 1100 °C (consider specific heat of material is 0.13 kCal / kg °C and calorific value of furnace oil is 10,000 kCal/kg) is _______.
   a) 60 %
   b) 70 %
   c) 80 %
   d) None of the above

4. In FBC boiler the combustion is carried out at a temperature
   a) Closer to saturated steam temperature
   b) Below ash fusion temperature of fuel used
   c) At adiabatic combustion temperature of fuel
   d) At and above ash fusion temperature of fuel

5. Turbine cylinder efficiency is given as a ratio of________________________
   a) **Actual enthalpy drop and isentropic enthalpy drop**
   b) Useful heat and power output
   c) Useful power and heat output
   d) All of the above

6. ~~The effectiveness of a heat exchanger depends on~~
   ~~a) Specific heat of hot fluid~~
   ~~b) Specific heat of cold fluid~~
   ~~c) Inlet temperature of hot fluid~~
   ~~d) LMTD~~

Note: 1 Mark is awarded to all candidate who have attempted this question.

7. ~~Efficiency evaluation requires~~
   ~~a) Ash in fuel~~
   ~~b) O_2 in flue gas~~
   ~~c) Sulphur in fuel~~
   ~~d) NOx in flue gas~~

Note: 1 Mark is awarded to all candidate who have attempted this question.

8. The evaporation ratio of a coal-fired boiler is 4. Steam enthalpy is 640 kCal/kg; feed water temperature is 55 ^{0}C, Calorific Value of coal is 4000 kCal/kg. The boiler efficiency is ________
   a) 49 %
   b) 82 %
   c) **58.5 %**
   d) 70 %

9. Removal of dissolved gases from the boiler feed water is called
   a) Degasification
   b) **Deaeration**
   c) Deoxidation
   d) None of the above

10. Which one of the following is a high temperature heat recovery device?
    a) **Regenerator**
    b) Heat pump
    c) Heat wheel
    d) Heat pipe

11. In reheating furnace, scale losses will
    a) **Increase with excess air**
    b) Decrease with the excess air
    c) Have no relation with excess air
    d) Increase with CO_2% in flue gas

12. Transfer of heat without a conveying medium is possible with

a) Conduction b) **Radiation**
c) Convection d) None of the above

13. Which of the following increases, when high pressure steam is discharged to atmosphere?

a) Sensible heat b) Total enthalpy of steam
c) Saturation temperature d) **Specific volume**

14. Removal of condensate from main steam line is done to prevent

a) Steam locking b) Air locking
c) **Water hammer** d) All of the above

15. For flash steam calculation, flash steam quantity available depends upon

a) **Condensate pressure and flash steam pressure**
b) Steam pressure
c) Steam enthalpy at atmospheric pressure
d) Total heat of flash steam

16. Air venting in a steam system is required because air is ___________.

a) A good conductor b) **An insulator**
c) Inert d) Diluent

17. Furnace wall heat loss does not depend on

a) Temperatures of external wall surfaces b) Velocity of air around the furnace
c) Thermal conductivity of wall brick d) **Material of stock to be heated**

18. In a CFBC boiler _________ are required to capture large recycled amount of bed material

a) Settling chambers b) **Mechanical cyclones**
c) Bag filters d) Scrubbers

19. Example for basic type of refractory is

a) Chrome b) **Chrome magnesite**
c) Alumina d) All the above

20. Which material is used to control SO_2 emissions in FBC boilers

a) CaO b) **Lime stone**
c) Silica d) Sand

21. The effectiveness of a heat exchanger does not depend on

a) Specific heat of hot fluid b) Specific heat of cold fluid
c) Inlet temperature of hot fluid d) **LMTD**

22. Which of the following fuel needs maximum amount of excess air for complete combustion?

a) Furnace oil b) Natural gas
c) Pulverised coal d) **Wood**

23. In a coal fired boiler, which parameter influences flame profile the most?

a) Fixed carbon b) **Volatile matter**
c) Hydrogen d) All of the above

24. Which one of the following boilers utilizes the combination of suspension and grate firing?

a) **Spreader stoker boiler** b) Fluidized bed boiler
c) Traveling grate stoker boiler d) Pulverized fuel boiler

25. In an oil fired steam boiler the Air to Fuel ratio by mass is 15:1 & evaporation ratio is 14:1. The flue gas to fuel ratio will be

a) 29:1 b) **16:1**
c) 1:1 d) 15:1

26. The maximum possible evaporation ratio of a boiler (From & At 100 °C basis) fired with coal having a calorific value of 4050 kcal/kg and operating at 80 % efficiency will be

a) 5 b) **6**
c) 7.5 d) 9.4

27. When solutions of differing concentrations are separated by a semi-permeable membrane, water from less concentrated solution passes through the membrane to dilute the liquid of high concentration. This is called

a) Reverse osmosis b) Ion exchange
c) Softening d) **Osmosis**

28. Radiation losses from the surface of a boiler practically
   a) Increase with increase in boiler loading
   b) Decrease with increase in boiler loading
   c) **Are independent of boiler loading**
   d) Are dependent on boiler loading

29. Desirable boiler water pH should be ?
   a) 5 - 7
   b) **7 - 9**
   c) 9 - 11
   d) None of the above

30. Soot deposition on boiler tubes is due to
   a) Poor water treatment
   b) High moisture content in fuel
   c) High excess air
   d) **Incomplete combustion**

31. If 10 % air is entrained in a steam system at 5 kg/cm^{2}g then the saturation temperature of steam will be
   a) **Less than the saturation temperature at 5 kg/cm^{2}g**
   b) More than the saturation temperature at 5 kg/cm^{2}g
   c) Equal to the saturation temperature at 5 kg/cm^{2}g
   d) Equal to the saturation temperature at 5.5 kg/cm^{2}g

32. In a pressure reduction valve, which of these does not change?
   a) Temperature
   b) Pressure
   c) Velocity
   d) **Enthalpy**

33. Steam at 6 bar has a sensible heat of 159.33 kcal/kg and latent heat of 498.59 kcal/kg. If the steam is 95 % dry then the total enthalpy is
   a) 625 kCal/kg
   b) 649.95 kCal/kg
   c) 553 kCal/kg
   d) **633 kCal/kg**

34. Select the wrong statement with respect to steam traps
   a) Discharges condensate as soon as it is formed
   b) Does not allow steam to escape
   c) Capable of discharging air and other incondensable gases
   d) **Does not allow condensate to escape**

35. Velocity of steam in steam pipe is directly proportional to _______________
   a) Number of bends in pipe
   b) **Specific volume of steam**
   c) Length of pipe
   d) Diameter of the pipe

36. In a typical industrial steam distribution, the commonly used trap for main steam pipe lines is
   a) Thermostatic trap
   b) Inverted bucket trap
   c) **Thermodynamic trap**
   d) Open bucket trap

37. For same inlet conditions of the steam, which of the following will generate the maximum mechanical power ?
   a) **Condensing turbine**
   b) Back pressure turbine
   c) Extraction-cum-condensing turbine
   d) Extraction-cum-back pressure turbine

38. In an oil fired heat treatment furnace, which of the following is not required to determine its efficiency by direct method ?
   a) Weight of input material
   b) **Oxygen percentage in flue gas**
   c) Fuel consumption
   d) Calorific value of fuel

39. In a coke fired cupola, carbon monoxide is produced in the
   a) Preheating zone
   b) **Reducing zone**
   c) Combustion zone
   d) Melting zone

40. Tuyeres is a part of the equipment associated with
   a) Induction furnace
   b) Re-heating furnace
   c) Electrical melting arc furnace
   d) **Cupola**

41. An increase in bulk density of a refractory increases its
   a) Thermal conductivity
   b) Heat capacity
   c) Resistance to slag penetration
   d) **All of the above**

42. The storage heat losses in a batch type furnace can be best reduced by
   a) Fire Clay brick
   b) **Ceramic fibre**
   c) High alumina brick
   d) High silica brick

43.	Emissivity is a measure of material's ability to a) Only absorb heat b) Only radiate heat c) **Absorb and radiate heat** d) None of the above
44.	Which of the following depends on physical properties of fluids as well as geometry of the heat exchanger ? a) **Overall heat transfer coefficient** b) Fouling coefficient c) LMTD d) Effectiveness
45.	The waste heat boiler application is not suitable for which of the following? a) Gas turbine b) Diesel engine c) Oil fired furnaces d) **Hot air dryers**
46.	Moisture content in coal a) Increases heat loss due to evaporation and superheating of water vapour b) Helps in binding fines c) Aids in radiation heat transfer d) **All of the above**
47.	With respect to properties of steam a) The sensible heat decreases as the pressure increases b) The latent heat increases as the pressure increases c) The specific volume increases as the pressure increases d) **The specific volume decreases as the pressure increases**
48.	Oxidation of carbon to CO_2 yields 8084 kcal/kg of carbon. Oxidation of carbon to CO in the flue gas yields 2430 kcal/kg of carbon. Oxidation of CO to CO_2 will yield a) **5654 kCal** b) 5800 kCal c) 5464 kCal d) 540 kCal
49.	The maximum loss that takes place in a fully condensing steam turbine power plant is a) Flue gas loss b) Steam distribution loss c) Radiation and insulation loss d) **Condenser losses**
50.	The difference between mean solid and mean gas velocity in FBC boiler is called a) Fluidization factor b) **Slip velocity** c) Settling velocity d) Terminal velocity

.... End of Section – I ....

Section - II: SHORT DESCRIPTIVE QUESTIONS **Marks: 8 x 5 = 40**

(i) Answer all **Eight** questionss

(ii) Each question carries **Five** marks

S1	Write short notes on wet and dry methods of preservation of boiler.
Ans	**Refer BEE Guide Book 2- Chapter 2, Page No: 54 - 55**
S2	Explain the phenomenon of water hammer in steam system and how it can be eliminated ?
Ans	**Refer BEE Guide Book 2- Chapter 3, Page No: 91**
S3	A counter flow double pipe heat exchanger using hot process liquid is used to heat water which flows at 20 m^3/hr. The process liquid enters the heat exchanger at 180 ^{0}C and leaves at 130 ^{0}C. The inlet and exit temperatures of water are 30 ^{0}C and 90 ^{0}C. Specific heat of water is 4.187 kJ/kg K. Calculate the heat transfer area if overall heat transfer coefficient is 820 W/m^2 K. What would be the percentage increase in the area if fluid flow were parallel assuming same overall heat transfer coefficient?

Ans

Counter Flow

- Water inlet temperature 30 ^{0}C
- Water outlet temperature 90 ^{0}C
- Flow rate of water 20 m^3/hr
- Heat content in water = 20000*(60)* 4.187=5024400 kJ/hr=1395.6 kW
- Process fluid inlet temperature = 180 ^{0}C
- Process fluid outlet temperature = 130 ^{0}C
- ΔT_1=90, ΔT_2 =100
- T_{LMTD} = $(\Delta T_1 - \Delta T_2)/(\ln(\Delta T_1/\Delta T_2))$ = 10/ln(100/90) = **94.91 ^{0}C**
- U = 820 W/m^{20}C
- H= UAT_{LMTD} = 1395.6*1000/(95*820) = **17.9 m^2**

Parallel flow:

ΔT_1=150, ΔT_2 =40

- T_{LMTD} = $(\Delta T_1 - \Delta T_2)/(\ln(\Delta T_1/\Delta T_2))$ = 110/ln(150/40) = **83.2 ^{0}C**
- U = 820 W/m^{20}C
- H= UAT_{LMTD} = 1395.6*1000/(83.2*820) = 20.45 m^2

% Increase in area = ((20.45-17.9)/17.9) x 100 = 14.24 % increase

S4

A continuous process industry is operating with a 2 MW DG Set with 80 % load to meet the power requirements of the plant. The specific fuel consumption of the DG set is 4 kWh/liter. On energy auditor's suggestion, a waste heat recovery boiler was installed to recover heat from exhaust gas and generating 800 kg/hr of saturated steam at 10 kg/cm^2.

The waste heat recovery boiler operating data are given below.

•	Feed water temperature	=	60 ^{o}C
•	Enthalpy of steam at 10 kg/cm^2	=	660 kCal/kg
•	Specific gravity of diesel	=	0.85
•	GCV of diesel	=	10500 kCal/kg

Calculate the following. (each carries 2.5 Marks)

a) Efficiency of DG set before waste heat recovery boiler installation

b) Cogeneration system efficiency after waste heat recovery boiler installation

Ans

Diesel consumption Litre / hour

= ((2 x 1000) x 0.8)) / 4 = 400 litre / hour

a) DG set efficiency

= $\frac{\text{2000 kWh/hr x 0.8 loading x 860 kcal/kWh}}{\text{400 lit x 0.85 kg/lit x10500 kcal/kg}}$ x100 = 38.54 %

b) Co-gen System Efficiency after WHR boiler installation

$\frac{\text{[2000 kW x 0.8 loading x 860 kcal/hr/kW + (800 kg steam /hr x (660-60) kcal/kg]}}{\text{[400 lit x 0.85 kg/lit x10500 kcal/kg]}}$ x100 = 52%

S5

A coal fired thermic fluid heater is used to supply heat to a dryer. The hot oil circulation is supplied at 270 ^{o}C, with a flow of 100 m^3/hr and operating with temperature difference of 20 ^{o}C. Estimate the coal requirement if the thermal efficiency of the heater is 65 % and GCV of the coal is 4200 kCal/hr.

Consider specific heat & density of the thermic fluid to be 0.55 kcal/kg ^{o}C& 820 kg/m^3 respectively.

Ans	Absorbed heat in thermic fluid = m * Cp * Δ T = (100 * 820) * 0.55 * 20 **= 902000 kcal/hr** Thermal efficiency of the heater = absorbed duty / input heat duty Mass of coal required = absorbed duty / (efficiency * calorific value of coal) = 902000 / (0.65 * 4200) **= 330.4 kg/hr**
S6	In a heat exchanger, steam is used to heat 3000 litres/hr of furnace oil from 30 °C to 100 °C. The specific heat of furnace oil is 0.22 kCal/ kg/°C and the density of furnace oil is 0.95. How much steam per hour is needed if steam at 4 kg/cm^2 with latent heat of 510 kCal/kg is used ? If steam cost is Rs.4/kg and electrical energy cost is Rs.8/kWh, which type of heating would be more economical in this particular case? (assume no losses in electrical and steam heating process)
Ans	Total heat required = m Cp ΔT = (3000 x 0.95) x 0.22 x (100-30) = 43890 kcal/hr a) Amount of steam required = 43890/510 = 86 kg/hr Steam cost = 86 x Rs.4 = Rs. 344/hr b) Amount of electricity required = 43890/860 = 51 kWh = 51 x Rs. 8 = Rs.408/ hr Answer : Steam heating will be more economical
S7	Calculate the reduction in pressure drop in meters when pipe diameter is increased from 250 mm to 350 mm for a length of 500 meters. The water velocity is 2 m/s in the 250 mm diameter pipe, and friction factor is 0.005.
Ans	Pressure drop = 4fLV^2/ 2gD Pressure drop with250 mm = (4 x 0.005 x 500 x 2^2)/ (2 x 9.81 x 0.250) = 8.155 m Velocity of water in pipe of 350 mm diameter = (0.25 x 0.25 x 2) /(0.35 x 0.35) = 1.02 m/s Pressure drop with350 mm = (4 x 0.005 x 500 x1.02^2)/ (2x9.81 x0.350) = 1.515 m Pressure drop reduction = 8.155 – 1.515 = **6.64 m**

S8	In a process plant 200 kg/hr of hot condensate at 6 bar(g) having a sensible heat of 166 kCal/kg is discharged. The plant also requires low pressure steam at a pressure of 1 bar(g) for heating application. Find out the quantity of flash steam generated in the flash vessel in kg/hr. The condensate at a pressure of 1 bar(g) has a sensible heat of 120 kCal/ kg and a latent heat of 526 kCal/kg.
Ans	$$\text{Flash steam available \%} = \frac{S1 - S2}{L2} \times 100$$ Where, S_1 = is the sensible heat of higher pressure steam S_2 = is the sensible heat of steam at lower pressure L_2 = is the latent heat of flash steam at lower pressure $$\text{Flash steam generated} = \left(\frac{166 - 120}{526}\right) \times 200\ \text{Kg/hr} = 17.49\ \text{kg/hr}$$

.... End of Section – II ....

Section - III: LONG DESCRIPTIVE QUESTIONS **Marks: 6 x 10 = 60**

(i) Answer all **Six** questions

(ii) Each question carries **Ten** marks

L1	a) Write short notes on the following (each carries 2.5 Marks) • Advantage of Micro turbine in Steam System • Trigeneration with example b) Why is individual trapping preferred over group trapping? (5 Marks)
Ans	a) • (Refer BEE Guide book 2, Chapter 7, Page No-209) • (Refer BEE Guide book 2, Chapter 7, Page No-208) b) (Refer BEE Guide book 2, Chapter 7, Page No-208)
L2	Explain the following (each carries 5 Marks) • Advantages of using ceramic fibre in furnaces • Advantages of using fluidized bed boilers
Ans	• (Refer BEE Guide book 2, Chapter 5, Page No:164-165) • (Refer BEE Guide book 2, Chapter 6, Page no: 182-183)
L3	An air preheater in a 90 TPH induced draft boiler was showing the following readings: i. Flue gas inlet temperature: 319.5 ^{0}C ii. Flue gas Outlet temperature: 160 ^{0}C iii. Air inlet temperature: 70 ^{0}C iv. Air outlet temperature: 210 ^{0}C

	The steam to fuel ratio is 12 and air to fuel ratio is 14. It was found that there was air ingress from atmosphere to flue gas side. Ambient air temperature was 30 ^{0}C. Assuming that the specific heat capacity of air and flue gas to be the same at 0.24 kcal/kg K and the amount of heat picked up by fresh air remains the same. Calculate the following: (each carries 5 Marks) a) The amount of air ingress into the flue gas path. b) The flue gas temperature after air preheater in case of no air leak to flue gas circuit.
Ans	a. Steam flow: 90TPH Steam to fuel ratio: 12 ➔ fuel consumed is 7.5 TPH Air to fuel ratio: 14➔ air used in boiler is 105 TPH Flue gas = Air + Fuel ➔ Flue gas = 105+7.5 = 112.5 TPH Air ingress is at 30 deg C. Making an energy balance around APH: we get 112.5 * 319.5 + 105 * 70 + x * 30 = 105 * 210 + (112.5+x) *160 Solving for x, we get air ingress to be 25 TPH **Flue Gas Temperature** b. ➔ 112.5 * 319.5 + 105 * 70 = 105*210+112.5* T Solving for T, we get the corrected flue gas temperature to be 189 ^{o}C
L4	As a part of energy conservation measure, APH (Air Pre-heater) is installed in a forced draft furnace. The APH is designed to pre-heat 240 m^3/min of combustion air to 250 ^{0}C. Flue gas enters the APH at 375 ^{0}C. Calculate the flue gas quantity leaving the stack and also determine the improvement in furnace efficiency after the installation of APH with the following data, Density of air : 1.15 kg/m^3 Specific heat of air : 0.24 kCal/kg ^{0}C Specific heat of flue gas : 0.2 kCal/kg ^{0}C Amount of fuel fired : 920 kg/hr Calorific value of fuel : 9850 kCal/kg Air to fuel ratio : 18 Efficiency of furnace : 80 % Ambient temperature : 30 ^{0}C
Ans	**Solution:** Amount of Air flow = 240 * 60 * 1.15 = 16560 kg/hr Amount of fuel = 16560 / 18 = 920 kg/hr Amount of flue gas = 16560 + 920 = 17480 kg/hr Heat gain by combustion air = 16560 * 0.24 * (250 – 30) = 874368 Kcal/hr Temperature difference in flue gas = 874368 / (17480 * 0.2) = 250 °C Flue gas leaves the stack at temp = 375 – 250 = 125 °C Efficiency of APH = Heat absorbed by air / Heat input * 100 = 874368 / (920* 9850) * 100

	= 9.6 % Overall efficiency after APH = 80 + 9.6 % = 89.6 %
L5	An oil fired Boiler is generating 100 TPH of steam at 85 % efficiency and operating 330 days in a year. The management has installed a water treatment plant with Rs. 2 Crore investment for reducing the Total Dissolved Solids (TDS) in boiler feed from 450 ppm to 150 ppm. The maximum permissible limit of TDS in the boiler is 3000 ppm and make up water is 10 %. The temperature of blowdown water is 175 ^{0}C and the boiler feed water temperature is 45 ^{0}C. The calorific value of fuel oil is 10,200 kCal/kg. Calculate the payback period if the cost of fuel is Rs. 45,000 per ton.
Ans	Blow down % = $\frac{\text{Feed water TDS * \% make up water * 100}}{\text{(maximum permissible TDS in boiler water – Feed water TDS)}}$ Initial blow down = 450 * 10 / (3000 – 450) Initial blow down = 1.764 % Improved blow down = 150 * 10 / (3000 – 150) Improved blow down = 0.526 % Reduction in blow down = 1.76 – 0.526 Reduction in blow down = 1.238 % Reduction in blow down = 1.238 * 100 * 1000 / 100 Reduction in blow down = 1238 kg/hr Specific heat of water is 1 kcal/kg°C Heat savings = m * Cp * ($T_1 – T_2$) = 1238 * 1 * (175 – 45) Heat savings = 160940 kcal/hr Fuel Oil saving = 160940 / (10200 * 0.85) = 18.6 kg/hr = 18.6 * 24 * 330 / 1000 = 147 MT / annum Fuel Oil – cost savings = 147* 45000 = Rs. 66 lakh Investment on water treatment plant = Rs. 2 Crore Payback period = 2 / 0.66 Payback period = 3.0 years (or) 36 months
L6	In a leather industry, a leather drier requires 80 m^3/min of air at 92 ^{0}C, which is heated by wood fired thermic fluid heater. The density of air is 1.2 kg/m^3 and specific heat of air is 0.24 kcal/kg ^{0}C. The inlet air temperature to the drier is 32 ^{0}C and the drier is operating for 8 hrs per day. The efficiency of the wood fired heater and its distribution piping system is 50 %. The gross calorific value and the cost of purchased wood are 2000 kCal/kg and Rs. 5000 per ton. The auxiliary power consumption for operating the thermic fluid heater is 10 kW. The energy auditor recommended replacing the existing drying system with a 40 kW infrared electric heater drier. The kW loading of the proposed drier will be 70 % over an 8 hour plant operating period. The investment for the new drier is Rs. 10 Lakhs. If the cost of electricity is Rs. 7/kWh, calculate the following : a) Find out the annual energy cost savings of replacement of thermic fluid system with infra-red heater ? (7 Marks) b) Find out the payback period. (3 Marks)

Ans	**Cost of wood fired thermic fluid heater operation** Air flow rate (vol) = 80 m3/min x 60 = 4800 m3/hr Air flow rate (mass) = 4800 x 1.2 = **5760 kg/hr** Sensible heat of air = m x Cp x T = 5760 x 0.24 x (92-32) = **82944 kcal/hr** Efficiency of wood fired heater =50% Wood consumption = 82944/(2000 x0.5) per hr=**83 kg per day** Cost of wood **per day** = 83 xRs 5 x 8 hour = **Rs 3320 per day** Cost of Auxiliary electricity = **10 kW x 8 hrs x 7 = Rs.560** **Total cost of operation = 3880 Rs.** **Cost of Infra-red heater operation** Electric heater rating= 40 kw Electricity consumption per day= 40 kw x 0.7 x8hr = 224 kwh per day = 224 x Rs 7= **Rs 1568 per day** Cost saving potential = 3880- 1568 = Rs2312 Annual saving potential = 2312 x 300 days = **Rs. 6.94 lakhs** **Investment= 10 lakhs** **Payback period= 10/6.94= 17 months or 1.4 years** **Or** Annual saving potential = 2312 x 365 days = **Rs. 8.44 lakhs** **Investment= 10 lakhs** **Payback period= 10/8.44= 14 months or 1.2 years**

.... End of Section – III ....