

E-3235

**B.E. Vth Semester (Main & Re-Exam) Examination,
December 2013**

**I.C Eng. Steam & Nuclear Power
Mechanical Engg.**

Time: Three Hours]

[Maximum Mark : 75

[Minimum Mark : 30

Note : Attempt all the questions of Section-A, four from Section-B and three questions from Section-C.

Section-A

(Objective Type Question)

Note: This section will contain ten objective type questions. They may be fill in the blanks, True/False or Multiple Choice Type. $1.5 \times 10 = 15$ (75)

1. (i) Which of the following motor cycles has one cylinder

- (a) Bullet
- (b) Yezdi
- (c) Rajdoot
- (d) Yamah

(ii) In which Cycle Gas Engine operate

- (a) Otto cycle
- (b) Diesel cycle
- (c) Dual cycle
- (d) Carnot cycle

P.T.O.

(iii) For Economy (minimum fuel consumption) the air fuel ratio for Petrol Engine is of the

- (a) 9:1
- (b) 12:1
- (c) 16:1
- (d) 20:1

(iv) A Diesel Engine is generally more efficient than a Petrol Engine because of

- (a) Proper air fuel mixing and combustion
- (b) High calorific value of diesel fuel
- (c) Knock-free operation
- (d) high compression ratio

(v) What is the order of Injection pressure in diesel engine

- (a) 30-40 bar
- (b) 100-150 bar
- (c) 170-220 bar
- (d) 400-600 bar

(vi) What is injection temperature of diesel fuel

- (a) 200°C
- (b) 400°C
- (c) 550°C
- (d) 700°C

(vii) What is the order of delay period in petrol engine

- (a) .001s
- (b) .002s
- (c) .015s
- (d) .06s

(VIII) What is the efficiency of chimney is approximately.

(a) 80%

(b) 40%

(c) 20%

(d) 25%

(ix) What is the average thermal efficiency of a modern nuclear power plant

(a) 30%

(b) 40%

(c) 60%

(d) 80%

(x) Which of the following are fertile materials

(a) U^{238} and Th^{239}

(b) U^{238} and Th^{232}

(c) U^{233} and Pu^{239}

(d) U^{238} and Pu^{239}

Section-B

(Short Answer Type)

Note : This section will contain six questions. Students will ask to attempt any four questions out of six questions. $6 \times 4 = 24$ (75)

1. Give the layout of a modern steam power plant and explain it briefly.

2. Write short notes on the following.

(i) Supercharged boilers

(ii) Velox boiler

(iii) Benson boiler

Power
Nuclear Answer

3. How are nuclear power plants classified? Explain how fission reactor takes place and how the chain reaction is controlled.
4. Difference between BWR and PWR.
5. What are the difference between battery and magneto-Ignition system.
6. Difference between I.C. Engine and S.I. Engine.

Section-C

(Long Answer Type Question)

Note: This section will contain **five** questions. Students will ask to attempt any **three** questions out of five questions.

1. Draw a neat diagram of CANDO type reactor and explain its working principle, Advantages & Disadvantages over the other types.
2. During a 10 hours run from one station to another a railway engine develops an average power of 1200Kw If the engine is driven by an atomic power plant of 20% efficiency. How much U^{235} would be consumed on the run? Each U^{235} atom on fission released 180 Mev of energy.
3. (a) Why is condenser used in steam power plant. Discuss the working of different parts of surface condenser.
4. Write the short notes on any four :
 - (i) Scavenging
 - (ii) Fuel Injection and combustion
 - (iii) Air and water cooling
 - (iv) Nuclear Safety devices
 - (v) Draft system
5. A six cylinder, four stroke diesel engine develops 125kw at 3000 rpm. Its brake specific fuel consumption is 200g/kwh. Calculate the quantity of fuel to be injected per cycle per cylinder specific gravity of the fuel may be taken as 0.85.

E-3484

B. E. (V Semester) (Main & Re-Exam) : December, 2014

IC ENGINE, STEAM & NUCLEAR POWER

Branch : Mechanical Engg.

Time : Three Hours]

[Maximum Marks : 75

[Minimum Marks : 30

Note : Attempt *all* the questions of **Section A**, *four* from **Section B** and *three* questions from **Section C**.

SECTION – A

(Objective Type Questions)

[$1.5 \times 10 = 15$

1. In a surface condenser if air is removed there is :

- (a) Fall in absolute pressure maintained in condenser
- (b) Rise in absolute pressure maintained in condenser
- (c) No change in absolute pressure in the condenser
- (d) Rise in temperature of condensed steam

P.T.O.

2 Rohat cycle in steam power plant is used to

- (a) Utilise heat of flue gases
- (b) Increase thermal efficiency
- (c) Improve condenser performance
- (d) Reduce loss of Heat

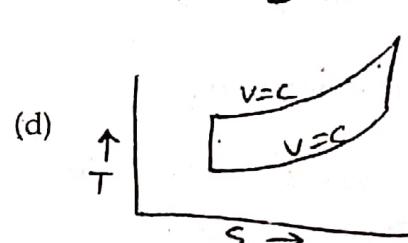
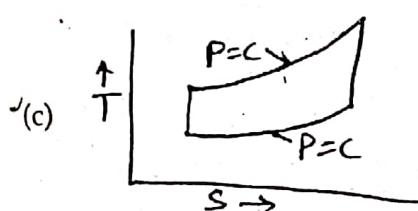
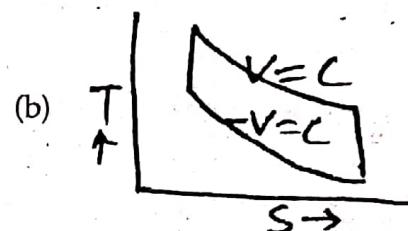
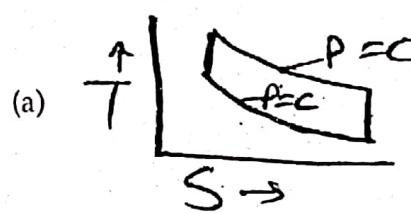
3 Pulverised fuel is used for :

- (a) Saving fuel
- (b) Better burning
- (c) Obtaining more heat
- (d) All of these

4 Tarapur Nuclear Power Plant has :

- (a) Pressurised water reactor
- (b) Boiling water reactor.
- (c) CANDU type reactor
- (d) None of these

5 Which one of the thermodynamic cycles shown in following figure represents that of Brayton cycle :



(2)

6. In a four stroke cycle S. I. engine the camshaft runs :

- (a) At the same speed as crank shaft
- (b) At half the speed of crank shaft
- (c) At twice the speed of crank shaft
- (d) At any speed irrespective of crank shaft speed

7. The efficiency of an ottocycle is 60% and $\gamma = 1.5$ what is the compression ratio ?

- (a) 4.25
- (b) 5.25
- (c) 6.25
- (d) 4

8. Fuel is injected in to the cylinder at the end of :

- (a) Compression stroke
- (b) Expansion stroke
- (c) Exhaust stroke
- (d) Power stroke

9. The air fuel ratio of the petrol engine is controlled by :

- (a) Fuel pump
- (b) Injector
- (c) Carburettar
- (d) Governor

10. Water Boile when its vapour pressure

- (a) Equals that the surrounding
- (b) Equals 760 mm. of Hg
- (c) Equals to atmospheric pressure
- (d) Equals the pressure of water in the container

SECTION - B

(Short Answer Type Questions)

[$6 \times 4 = 24$

1. Derive an expression for air-fuel ratio of a simple carburetor.
2. A six cylinder, four stroke diesel engine develops 125 kW at 3000 rpm. Its brake specific fuel consumption is 200 gm/kWh. Calculate the quantity of fuel to be injected per cycle per cylinder. Specific gravity of the fuel may be taken as 0.85.
3. Discuss the difference between ideal and actual valve timing diagram of a petrol engine.
4. Explain the two types of cooling system and compare them.
5. What do you understand by positive power coefficient and negative temperature coefficient? How these factors affect the performance of PWR & BWR?

(4)

6. A power of 6MW is being developed in a nuclear reaction.

- How many atoms of U²³⁵ undergoes fission per seconds?
- How many kilogram of U²³⁵ would be used in 1000 hours?

Assume that on an average 200 MeV is released per fission.

SECTION - C

(Long Answer Type Questions)

[12 x 3 = 36]

17.7

i. (a) What are the limitations of supercharging in an IC engine?

(b) A four stroke diesel engine working at Sea Level (Pressure 1 bar, temperature 17°C) develops a brake power of 280 kW with a volumetric efficiency of 80% at sea level conditions. The engine works at an air-fuel ratio of 18 : 1 with a specific fuel consumption of 0.240 kg/kWh. The engine runs at 1800 rpm. Determine the engine capacity and the bmeep.

This engine is taken to an altitude of 3 km, where the ambient temperature and pressure are -23°C and 0.715 bar. A mechanically coupled supercharger is fitted to the engine which consumes 12% of the total power developed by the engine. The temperature of air leaving the supercharger is 37°C. Determine the degree of super charging required to maintain the same brake power of sea level. Assume that air-fuel ratio, thermal efficiency and volumetric efficiency remains the same for naturally aspirated and supercharged engine.

(5)

P.T.O.

~~2~~ (a) What properties are required for a good coolant? Which gases are used as coolant? Why CO_2 is more preferable over other gases?

~~4~~ (b) What are the advantages of burning the fuels in pulverised form?

3. A single pass surface condenser of a small power plant condenses 10 tons of saturated steam at 0.2 bar per hour. The rise in the water temperature is limited to 20°C and temperature difference between the steam and water at outlet is 10°C . Taking overall heat transfer coefficient = $4 \text{ kW/m}^2 \text{ }^\circ\text{C}$. Find out the area of the condenser required.

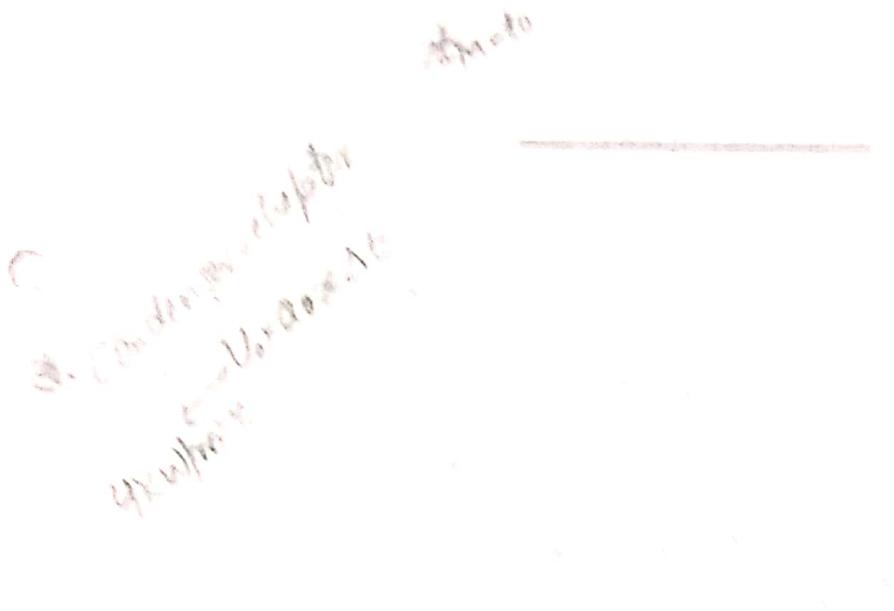
4. A boiler supplies $2/3$ steam at 30 bar and 300°C and $1/3$ steam at 5 bar and 270°C . The high pressure steam is supplied to H. P. turbine, where it expands to 5 bar. Part of the steam is bled and supplied to the direct mixing type feed water heater. The remainder is mixed with other $1/3$ of the steam coming from another boiler and is then supplied to the L. P. turbine where it expands to 0.07 bar. The condensate enters the feed water heater at 38°C and leaves at 180°C . Determine the fraction of steam bled and efficiency of the plant. If the steam generating capacity of the boiler is 20 tons/hr, find the power output capacity of the plant.

~~5~~ (a) Draw a neat diagram of Benson boiler and discuss its relative merits and demerits.

(6)

(B) What is nuclear fusion? How does it differ from nuclear fission?

(C) Draw T - S diagram of Rankine cycle using dry-saturated steam and develop the equation for the rankine cycle efficiency.



(7)

E-197

B.E. V Semester (Main & RE) Examination, Dec. 2015
IC Engine, Steam & Nuclear Power

Branch : M.E.*Time: Three Hours /**/ Max. Marks : 75**/ Min. Marks : 30*

Note : Attempt all the questions of Section-A, four from Section-B and three questions from Section-C.

Section-A**(Objective Type Questions)**

Note : This section will contain ten objective type questions. They may be fill in the blanks, True/False or Multiple Choice Type. $1.5 \times 10 = 15$

1. Rankine efficiency of a steam power Plant
 - (a) Improves in summer as compared to that in winter
 - (b) Improves in winter as compared to that in summer
 - (c) Is unaffected by climatic conditions
 - (d) None of the above

2. In regenerative cycle feed water is heated by
 - (a) Exhaust gases
 - (b) Heaters
 - (c) Draining steam from the turbine
 - (d) All of the above

3. Thermal efficiency of the engine with condenser as compared to without condenser, for a given pressure and temperature of steam is

(a) Higher	(b) Lower
(c) Same	(d) None of the above

P.T.O.

Section-B

(Short Answer Type)

Note : This section will contain **six** questions. Students will ask to attempt any **four** questions out of six questions. $6 \times 4 = 24$

1. In a Rankine cycle, the steam at inlet to turbine is saturated at a pressure of 35 bar and the Exhaust pressure is 0.2 bar. Determine - 6
 - (i) The pump work
 - (ii) The turbine work
 - (iii) The Rankine efficiency
 - (iv) The condenser heat flow

Assume flow rate of 9.5 kg/sec.
2. Describe with suitable sketches the following system of a modern carburettor 6
 - (i) Main metering system
 - (ii) Idling system
 - (iii) Economizer system
 - (iv) Acceleration Pump system
 - (v) Choke
3. Why fins and baffles are required in an air-cooled engine? 6
4. Explain the pressurised water reactor and Boiling water reactor, also explain advantages & Disadvantages of both reactor. 6
5. What is the reason for inefficiency in surface condensers. 6
6. Explain with neat sketches the construction and working of Lamont boiler and Velox boiler. 6

Section-C

(Long Answer Type)

Note : This section will contain **five** questions. Students will ask to attempt any **three** questions out of five questions. $12 \times 3 = 36$

1. A city requires 1500 MWh of Electric energy per day. It is to be supplied by a reactor which converts nuclear energy in to electric energy with an efficiency of 20%. If reactor used nuclear fuel of U^{235} , calculate the mass of U^{235} needed for one day operations. 12

2. A boiler produces 200 Kg of dry and saturated steam per hour at 10 bar and feed water is heated by an economiser to a temperature of 110°C . 225 kg of coal of a calorific value of 30100 kJ/kg are fired per hour. If 10% of coal remains unburnt, find the thermal efficiency of the boiler and grate combined. 12
3. An experimental four-stroke gasoline engine of 1.7 litre capacity is to develop maximum power at 5000 revolution per minute. The volumetric efficiency is 75% and the air-fuel ratio is 14 : 1. Two carburetors are to be fitted and it is expected that at maximum power the air speed at the choke is 100m/s. The coefficient of discharge for the venturi is assumed to be 0.80 and that of main jet is 0.65. An allowance should be made for emulsion tube, The diameter of which can be taken as 1/3 of choke diameter. The gasoline surface is 6mm below the choke at this engine condition. Calculate the size of a suitable choke and main jet. The specific gravity of the gasoline is 0.75. Pa and Ta are 1 bar and 300k respectively. 12
4. Derive an expression for the amount of fuel injected per cycle in terms of brake horse power and speed of a four stroke, diesel engine. 12
5. Show that the mean effective pressure of an Otto cycle may be expressed in the form,
- $$\frac{\eta_{th} \cdot \Delta P}{(r - 1)(\gamma - 1)}$$
- where η_{th} is the thermal efficiency of the cycle,
 ΔP is the pressure rise during the heat transfer to the cycle.
 r -compression ratio
 γ - ratio of specific heats of the working fluid. 12

E-326**B. E. V Semester (Main & Re-Exam.) – December, 2016****I. C. ENGINE, STEAM & NUCLEAR POWER**

Branch : Mech.

Time : Three Hours]

[Maximum Marks : 75

[Minimum Marks : 30

Note : Attempt all questions of Section - A, four questions from Section - B and three questions from Section - C.

SECTION – A[Marks : $1.5 \times 10 = 15$

(Objective Type Questions)

1. The thermodynamic cycle on which petrol engine works, is :

- | | |
|-------------------|--------------------|
| (a) Otto cycle | (b) Joule cycle |
| (c) Rankine cycle | (d) Stirling cycle |

2. A diesel engine has compression ratio from :

- | | |
|--------------|--------------|
| (a) 6 to 10 | (b) 10 to 15 |
| (c) 15 to 25 | (d) 25 to 40 |

3. The primary fuel used in nuclear power plants is :

- | | |
|----------------|----------------|
| (a) U_{235} | (b) U_{238} |
| (c) Pu_{239} | (d) Pu_{233} |

P.T.O.

SECTION - B
(Short Answer Type Questions)

[Marks : $6 \times 4 = 24$]

1. Write various methods used in full injection systems ? What are the requirements of an ideal injection system ?
2. What do you mean by supercharging ? Also write its advantages & disadvantages.
3. Discuss the various methods of water treatment.
4. In a simple Rankine cycle, the maximum temperature and pressure are 540°C and 7.0 MPa respectively and the minimum pressure is 10 KPa. Assume the turbine and pump efficiency both as 85%, calculate :
 - (a) Thermal efficiency
 - (b) Specific work
 - (c) Work ratio
5. A four stroke diesel engine has a piston diameter of 16.5 cm and a stroke of 27cm. The compression ratio is 14.3, the cut-off 4.23% of the stroke. and MEP 4.12 bar. The engine speed is 264 rev/min & the fuel consumption is 1.076 kg of oil per hour, having a calorific value of 39150 KJ/Kg. Calculate the efficiency of the engine.
6. Differentiate between light water reactors and heavy water reactors.

SECTION - C
(Long Answer Type Questions)

[Marks : $12 \times 3 = 36$]

1. The rating of a nuclear power plant for a submarine is 5MW, overall efficiency is 30%, the fuel is U^{235} . Find the amount of natural uranium needed to generate this power if the average energy released per fission for this fuel is 190 MeV.

2. With the help of neat diagram, explain the working of following boilers:
- Babcock & Wilcox boiler
 - Lamont boiler.
3. Derive an expression in terms of volume ratio for the ideal efficiency of the diesel engine cycle assuming constant specific heats. Also calculate this ideal efficiency for an engine with a compression ratio of 15 cutting off fuel at 5% of the stroke.
4. Explain the function of a condenser in a steam power plant. Also discuss the various types of condensers.
5. What is the principle of an electrostatic precipitator? With the help of a neat diagram, explain working of an electrostatic precipitator.

E-555

B. E. Vth Semester Examination – December, 2017

I. C. ENGINE, STEAM AND NUCLEAR POWER

Branch : Mechanical Engg.

(Main & RE Exam)

Time : Three Hours /

/ Maximum Marks : 75

Note : Attempt *all* the questions of Section – A, *four* questions from Section – B and *three* questions from Section – C.

SECTION – A

(Objective Type Questions)

[Marks : $1.5 \times 10 = 15$]

1. In a four-stroke cycle diesel engine, during suction stroke :

- (a) Only air is sucked in
- (b) Only fuel is sucked in
- (c) Mixture of A. E. is sucked in
- (d) None of the above

2. For some compression ratio & heat input, the cycle which has maximum efficiency may be :

- (a) Diesel cycle
- (b) Dual cycle
- (c) Otto cycle
- (d) None of the above

3. Super charging of I. C. engines is essential for :

- | | |
|-----------------------|-----------------------|
| (a) Marine engine | (b) Aircraft engine |
| (c) Stationary engine | (d) None of the above |

P. T. O.

E 55A

4. In carburetors, the top of the fuel jet with reference to the petrol level in the float chamber :
 - (a) Kept at same level
 - (b) Kept at slightly higher level
 - (c) Kept at lower level
 - (d) Varies from situation to situation
5. Increasing the compression ratio in B.I. engines :
 - (a) Increases the tendency for knocking
 - (b) Does not affect knocking
 - (c) Decreases the tendency for knocking
 - (d) None of the above
6. The ratio of brake power to indicated power :
 - (a) Mechanical efficiency
 - (b) Thermal efficiency
 - (c) Volumetric efficiency
 - (d) Relative efficiency
7. Rankine cycle comprises of :
 - (a) Two isentropic processes & two constant volume processes
 - (b) Two isentropic processes & two constant pressure processes
 - (c) Two isothermal processes & two constant pressure processes
 - (d) None of the above
8. The cooling section in the surface condenser :
 - (a) Increases the quantity of vapour extracted along with air
 - (b) Reduces the quantity of vapour extracted along with air
 - (c) Does not affect vapour quantity extracted
 - (d) None of the above

9. Which of the following fuel material occurred naturally ?
- U^{235}
 - Pu^{239}
 - U^{233}
 - Pu^{241}
10. In water tube boilers :
- Water passes through the tubes which are surrounded by flue gases
 - Flue gases passes through the tubes which are surrounded by water
 - Forced circulation takes place
 - None of these

SECTION – B

(Short Answer Type Questions)

[Marks : $6 \times 4 = 24$]

- Explain with suitable sketches the working of a four-stroke Otto engine.
- What are boiler mountings & accessories ? Explain :
 - Water level indicator
 - Superheater
- What is Supercharging ? Give the comparison of 'Actual Naturally Aspirated' & 'Supercharged engine' P-V diagram.
- A 2-stroke cycle I. C. engine has a mean effective pressure of 6 bar. The speed of the engine is 100 rpm. If the diameter of piston & stroke are 110 mm & 140 mm respectively. Find the indicated power developed.
- Calculate the fission rate of U^{235} for producing power of 1 Watt, if 200 MeV of energy is released per fission of U^{235} .
- Why the condenser is used in steam power plant ? Describe the operation of jet condenser.

SECTION - C
(Long Answer Type Question)

[Marks : $12 \times 3 = 36$]

1. Describe a simple carburetor with neat sketch & also find expression for air flow neglecting the compressibility of air.
 2. (i) Explain with neat sketch the working of Cochran boiler.
(ii) The engine of a car has 4 cylinder of 70 mm bore & 75 mm stroke. The compression ratio is 9. Determine the cubic capacity of the engine & the clearance volume of each cylinder.
 3. (i) Explain the essential parts of nuclear reaction with neat sketch.
(ii) Explain briefly the Pressurized Water Reaction (PWR).
 4. (i) Describe the operations & expression for the efficiency of Rankins Cycle.
(ii) What are the two main types of cooling system in I. C. engines ?
 5. The minimum pressure & temperature in an Otto cycle are 100 kPa & 27°C . The amount of heat added to the air per cycle is 1500 kJ/kg.
(i) Determine the pressure & temperatures of all parts of the air standard Otto cycle.
(ii) Also calculate the specific work & thermal efficiency of the cycle for a compression ratio of 8 : 1. Take for air : $C_v = 0.72 \text{ kJ/kg-k}$, $\gamma = 1.4$.
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E-868**B.E. V Semester (Main & Re-Exam.)****Examination, December - 2018****I.C. Engine, Steam & Nuclear Power****Branch : Mech.****Time : Three Hours /****/Maximum Marks : 75****/Minimum Marks : 30**

Note : Attempt all questions of **Section-A**, four questions from **Section-B** and three questions from **Section-C**.

Section-A**(Objective Type Questions)**

1. Nuclear reactor are used : $1.5 \times 10 = 15$
 - (a) To produce heat for thermoelectric
 - (b) To produce Fissionable material
 - (c) To propel ships, submarines, aircrafts
 - (d) All of these

2. A moderator generally used in nuclear power plants is :
 - (a) Graphite
 - (b) Concrete
 - (c) Heavy water
 - (d) Graphite and Concrete

P.T.O.

3. The predominant isotope of the naturally occurring element is :

(a) U_{235} (b) PU_{233}
(c) U_{238} (d) PU_{239}

4. The brake power of a diesel engine, keeping other parameters constant, can be increased by :

(a) Decreasing the density of intake air.
(b) Increasing the temperature of intake air.
(c) Increasing the pressure of intake air.
(d) Decreasing the pressure of intake air.

5. Theoretically, a four stroke cycle engine should develop _____ power as that of a two stroke cycle engine.

(a) Half (b) Same
(c) Double (d) Four times

6. The frictional power (F.P.) is given by :

(a) $F.P. = B.P. - I.P.$ (b) $F.P. = I.P. - B.P.$
(c) $F.P. = B.P. / I.P.$ (d) $F.P. = I.P. / B.P.$

7. In order to mix air and petrol in the required proportion and to supply it to the engine during suction stroke, this _____ is employed.

(a) Fuel pump (b) Injector
(c) Carburettor (d) None of these

8. The steam from steam generator of a nuclear power plant is best described as :

(a) Super heated steam (b) Super critical steam
(c) Saturated dry steam (d) Saturated wet steam

Section-B

(Short Answer Type Questions)

$$6 \times 4 = 24$$

1. Name and explain briefly various types of fuel injection systems.
 2. What are two main types of cooling systems? Where these systems are used?
 3. What is "nuclear fusion"? How does it differ from "nuclear fission"?
 4. Compare nuclear power station with steam power plant.
 5. A simple Ranking cycle works between pressure 28 bar and 0.06 bar, the initial condition of steam being dry saturated. Calculate the cycle efficiency, work ratio and specific steam consumption.
 6. A 4-cylinder, 2-stroke IC engine has the following particulars : engine speed=3000 rpm, bore=120mm crank Radius=60mm, mechanical efficiency = 90% and the engine develops 75 bhp. Calculate the swept volume and mean effective pressure (MEP).

Section-C

(Long Answer Types Questions)

$12 \times 3 = 36$

1. What is a nuclear reactor? How nuclear reactors are classified? Enumerate and explain essential components of nuclear reactor.
2. What is peted injection? What are its advantages & disadvantages? Explain continuous & Timed injection system.
3. What is steam turbine? How do they classify? Explain the working of any one steam turbine.
4. What is super charging? How is it achieved? What is the effect of super charging on the following parameters :
 - (a) Power output
 - (b) Mechanical efficiency
 - (c) Fuel consumption.
5. The rating of a nuclear power plant for submarine is 5MW, overall efficiency is 30% the fuel is U^{235} . Find the amount of natural uranium needed to generate this power if the average energy released per fission for this fuel is 190 Mev.