Code No: R161232   **R16**   SET - 1

I B. Tech II Semester Regular/Supplementary Examinations, April/May - 2018
ELEMENTS OF MECHANICAL ENGINEERING
(Civil Engineering)

Time: 3 hours   Max. 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 **FOUR** Questions from **Part-B**
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PART –A

1. a) What are the requirements of a good boiler?   (2M)

   b) Mention the advantages and disadvantages of casting process.   (2M)

   c) What are the uses of compressed air?   (2M)

   d) Explain the functions of piston rings and crankshaft of an IC engine.   (2M)

   e) What is meant by initial tension in a belt drive?   (2M)

   f) What is a gear train? What are its main types?   (2M)

   g) What is the difference between double-helical and herringbone gears?   (2M)

PART – B

2. a) Discuss the construction and working principle of Cochran boiler indicating the   (7M)
   flow path flue gases and water circulation.

   b) Discuss the construction and working principle of water level indicator and   (7M)
   pressure gauge.

3. a) Explain the principle involved in resistance welding. What are the different types   (9M)
   of resistance welding processes? Briefly explain each of these processes.

   b) Explain the principle and working of rolling process.   (5M)

4. a) Explain two stage reciprocating air compressor with the help of neat sketch.   (5M)

   b) Define the terms: (9M)
   (a) Refrigeration
   (b) Refrigerating effect
   (c) Ton of Refrigeration and
   (d) Refrigeration cycle.
   .

5. a) Discuss the principle of working of four stroke C.I and S.I engines.   (7M)

   b) A diesel engine has a brake thermal efficiency of 30 percent and develops brake   (7M)
   power of 60kw. If the calorific value of the fuel is 42000kJ/kg. Find its brake
   specific fuel consumption.

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6. a) What is meant by cross-belt drive? Find the length of belt in a cross-belt drive.   (7M)

   b) What is the effect of centrifugal tension on the tight and slack sides of a belt drive? Show that it is independent of the tight and slack side tensions and depends only on the velocity of the belt over the pulley.   (7M)

7. a) State and derive the law of gearing.   (7M)

   b) What types of gears are used for parallel, intersecting and skew shafts? Explain.   (7M)

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PART –A

1. a) What is the principle of operation of steam turbines? (2M)

    b) Name different types of patterns. (2M)

    c) Explain the principle of refrigeration. (2M)

    d) Explain the functions of connecting rod and flywheel of an IC engine. (2M)

    e) What is the effect of centrifugal tension on the power transmitted? (2M)

    f) What is a reverted gear train? Where is it used? (2M)

    g) What is the difference between Boiler mountings and accessories? (2M)

PART –B

2. a) Discuss the construction and working principle of fusible plug and steam stop valve. (7M)

    b) Describe the construction and working principle of Babcock and Wilcox water tube boiler and bent tube boilers indicating the flow path of flue gases and water circulation. (7M)

3. a) Explain the working principle of arc welding with a neat sketch. (7M)

    b) How is brazing different from soldering? Compare them with regard to methods adopted and their applications. (7M)

4. a) Explain briefly air refrigeration system with neat sketch. (7M)

    b) Derive the expression for the work done of a single stage, single cylinder reciprocating compressor in terms of mass flow rate of air, initial temperature, pressure ratio and index of compression. (7M)

5. a) Discuss the advantages and disadvantages of 2-strokes engines over 4-stroke engines. (7M)

    b) A one-litre cubic capacity, four stroke, four cylinder SI engine has a brake thermal efficiency of 30% and indicated power is 40kW at full load. At half load, it has a mechanical efficiency of 65%. Assuming constant mechanical losses, calculate: i) brake power ii) frictional power iii) mechanical efficiency at full load iv) indicated thermal efficiency. (7M)

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6. a) Discuss the effect of slip of belt on the pulleys on the velocity ratio of a belt drive. (7M)

    b) Discuss the relative merits and demerits of belt, rope and chain drive for transmission of power. (7M)

7. a) What is the difference between a simple gear train and a compound gear train? Explain with the help of sketches. (7M)

    b) A compound train consists of four gears. The number of teeth on gears A, B, C and D are 54, 75, 36 and 81 respectively. Gears B and C constitute a compound gear. Determine the torque on the output shaft if the gear A transmits 9kW at 200rpm and the train efficiency is 80%. (7M)

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PART –A

1. a) Differentiate between fire tube and water tube boilers.   (2M)

    b) Mention the advantages and disadvantages of Gas welding process.   (2M)

    c) Define "Ton of Refrigeration".   (2M)

    d) Explain the functions of piston and Gudgeon pin of an IC engine.   (2M)

    e) Explain an open belt drive with the help of a neat sketch.   (2M)

    f) Explain the terms: i) Module; ii) Addendum, as applied to gears.   (2M)

    g) Define specific fuel consumption and Indicated power of an IC engine.   (2M)

PART –B

2. a) Sketch and describe the working of a Lancashire Boiler.   (7M)

    b) Discuss the construction and working principle of Blow off cock and Economiser. (7M)

3. a) Explain briefly the steps involved in making a casting process.   (7M)

    b) Write short notes on Hot Extrusion Processes with the help of neat sketches.   (7M)

4. a) Explain Coefficient of Performance of a Refrigerator. State various applications of   (5M)
        Refrigeration.

    b) Determine the power required to compress and deliver 2 kg of air per minute from   (9M)
        1 bar and 20^0C to a delivery pressure of 7 bar, when the compression is carried out
        in a single stage compressor. The compression of air follows the law,
        $pv^{1.4}$=constant and R=287J/kg.K. Neglect clearance.

5. a) With the help of a neat sketch, explain the working of four stroke spark ignition   (7M)
        engine.

    b) A four stroke, compression ignition engine with four cylinders develops an   (7M)
        indicated power of 125 kW and delivers a brake power of 100 kW. Calculate (i)
        Frictional power and (ii) Mechanical efficiency of the engine.

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6. a) Derive the condition for maximum power transmission by a belt drive considering the effect of centrifugal tension. (7M)

    b) Find the power transmitted by a belt running over a pulley of 600 mm diameter at 200 rpm. The coefficient of friction between the belt and the pulley is 0.25, angle of lap is 160^0 and the maximum tension in the belt is 2500N. (7M)

7. a) Discuss a detailed classification of Gears. (7M)

    b) A compound gear train is formed by 4 gears P, Q, R and S. Gear P meshes gear Q and R meshes gear S. Gear Q and R are compounded. P is connected to the driving shaft and S is connected to the driven shaft and power is transmitted, the details of the gear are given below. Find speed of gear P if gear S rotates at 80 rpm. (7M)

GEARS	P	Q	R	S
No of teeth	40	80	50	100

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PART –A

1. a) Give the classification of boilers.   (2M)

    b) Discuss the purpose of Electrode in Arc welding process.   (2M)

    c) Give the classification of Air compressors.   (2M)

    d) Explain the functions of Cam shaft and Spark plug of an IC engine.   (2M)

    e) Define velocity ratio and slip of a belt drive.   (2M)

    f) Explain the terms: i) Pressure angle; ii) Dedendum, as applied to gears. (2M)

    g) Define Frictional power and Brake thermal efficiency of an IC engine.   (2M)

PART –B

2. a) Sketch and describe the working of a Locomotive Boiler.   (7M)

    b) Discuss the construction and working principle of Feed check valve and Air   (7M)
        preheater.

3. a) Explain the various types of forging operations and their working principles. (7M)

    b) Explain using simple sketches, the following pattern types: (i) Split pattern; (ii)   (7M)
        Cope and Drag pattern.

4. a) Explain the term Refrigeration. Discuss the various methods of producing   (7M)
        refrigeration.

    b) An air compressor takes in air at 1 bar and 20^0C and compresses it according to   (7M)
        law $pv^{1.2}$= constant. It is then delivered to a receiver at a constant pressure of 10
        bars. R= 0.287 kJ/kg K. Determine:
        (i)   Temperature at the end of compression
        (ii)   Work done per kg of air

5. a) What do you understand by TDC and BDC? In a suitable sketch, mark the two   (7M)
        dead centers.

    b) Determine the brake thermal efficiency of an engine which consumes 7 kg of fuel   (7M)
        in 20 minutes and develops a brake power of 65 kW. The fuel has a heating value
        of 42000 kJ/kg.

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6. a) Derive the relation for ratio of belt tensions in a flat belt drive. (7M)

   b) A pulley is driven by a flat belt running at a speed of 600 m/min. The coefficient of friction between the pulley and the belt is 0.3 and the angle of lap is 160^0. If the maximum tension in the belt is 700N, find the power transmitted by the belt. (7M)

7. a) Write short notes on Reverted gear train and compound gear train. (7M)

   b) Sketch two teeth of a gear and show the following: Face, Flank, Addendum, Dedundum, Tooth thickness, space width, face width and circular pitch. (7M)