B. Tech. (ME) (Elective-I) 6th Semester

(G Scheme) Examination, July-2022

INTERNAL COMBUSTION ENGINES AND GAS TURBINES

Paper-PEC-ME-320-G

Time allowed : 3 hours] *[Maximum marks : 75*

Note : *Attempt **five** questions in all, selecting **one** question from each unit. **Question No. 1 is compulsory.** All questions carry equal marks.*

1. (i) Classify engine.

(ii) Assumptions made in air standard cycles.

(iii) Properties of lubricating oil

(iv) Octane rating of fuels

(v) Explain BSFC, ISFC.

(vi) Chocking and stalling $6 \times 2.5=15$

Unit-I

2. Compare Otto, Diesel and Dual cycles for the : 15

(i) same compression ratio and heat input

(ii) same maximum pressure and heat input

(iii) same maximum pressure and temperature

(iv) same maximum pressure and work output

3. Explain : 15

(i) individual pump and nozzle system

(ii) unit injector system

(iii) common rail system

(iv) distributor system

Unit-II

4. Bring out clearly the process of combustion in CI engines and also explain the various stages of combustion. Explain the phenomenon of knock in CI engines. 15

5. Explain the following : 15

(i) thermosyphon cooling system

(ii) forced circulation cooling system

(iii) evaporative cooling system

(iv) pressure cooling system

Unit-III

6. The power output of a six cylinder four-stroke engi is absorbed by a water brake for which the law is W 20000 where the brake load, W is in Newton and t speed, N is in rpm. The air consumption is measu

by an air box with sharp edged orifice system. The following readings are obtained. Orifice diameter = 30 mm

Bore = 100 mm

Stroke = 120 mm

Brake load = 560 N

Speed = 2400 r.p.m.

C/H ratio by mass = 83/17

Coefficient of discharge = 0.6

Ambient pressure = 1 bar

Pressure drop across orifice = 14.5 cm of Hg

Time taken for 100 cc of fuel consumption = 20 s

Ambient temperature = 27°C

Fuel density = 831 kg/m^3

Calculate :

(i) the brake power

(ii) the torque

(iii) the brake specific fuel consumption

(iv) the percentage of excess air and

(v) the volumetric efficiency. 15

7. What are catalytic converters ? How do they help in reducing HC, CO and NOx emissions ? 15

Unit-IV

8. Discuss briefly the methods employed for improvement of thermal efficiency of open cycle gas turbine plant. Also describe with neat diagram a closed cycle gas turbine. State also its merits and demerits. 15

9. Explain the various types of rotary compressors. 15

B. Tech. (ME) 6th Semester (G Scheme)
Examination, July-2022

DYNAMICS OF MACHINES

Paper-PCC-ME-308-G

Time allowed : 3 hours] *[Maximum marks : 75*

Note : *Attempt **five** questions in all, selecting at least **one** question from each unit. **Question No. 1 is compulsory.** All questions carry equal marks.*

1. Explain the following : 6×2.5=15

(a) What do you mean by constraint forces and applied forces ?

(b) Why is balancing of rotating parts necessary for high speed engines ?

(c) Explain the term height of the governor.

(d) Distinguish between brakes and dynamometers.

(e) Explain what is meant by applied torque and reaction torque.

(f) What do you mean by spin, precession and gyroscopic planes ?

Unit-I

(a) What are free-body diagrams of a mechanism ? 8

(b) What do you mean by equivalent offset inertia force ? 7

3. State and explain D' Alembert's principle. 15

Unit-II

4. Four masses m_1, m_2, m_3 and m_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radiuses of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angle between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m. 15

5. Explain the 'Direct and reverse crank' method for determining unbalanced forces in radial engines. 15

Unit-III

6. A porter governor has equal arms each 250 mm long and pivoted on the axis of rotation. Each ball has a mass of 5 kg and the mass of the central load on the sleeve is 25 kg. The radius of rotation of the ball is 150 mm when the governor begins to lift and is 200 mm when the governor is at maximum speed. Find the minimum and maximum speed and range of speed of the governor.

7. Describe with sketches of torsion dynamometer and explain with detail the calculation involved in finding the power transmitted. 15

Unit-IV

8. The turbine rotor of a ship has a mass of 3500 kg. It has a radius of gyration of 0.45 m and a speed of 3000 r.p.m. clockwise when looking from stem. 15

   (i) When the ship is steering to the left on a curve of 100 m radius at a speed of 36 km/h.

   (ii) When the ship is pitching in a simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12 degrees.

9. Explain the gyroscopic couple and centrifugal couple for stability of a two wheel vehicle while taking a turn. 15

B. Tech. (ME) 6th Semester (G Scheme)

Examination, July-2022

HEAT TRANSFER

Paper-PCC-ME-306-G

Time allowed : 3 hours] *[Maximum marks : 75*

Before answering the questions, candidate should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : *Attempt **five** questions in all, selecting **one** question from each section. **Question No. 1 is compulsory.** All questions carry equal marks.*

1. Describe the following : 6×2.5=15

(a) Critical thickness of insulation

(b) Effectiveness of fin

(c) Transient heat conduction

(d) Types of heat exchanger

(e) Biot number

(f) Drop wise condensation

Section-A

2. Derive an expression for 3-D heat conduction equation in Spherical coordinate system. 15

3. A furnace wall consists of three layers. The inner layer of 10 cm thickness is made of firebrick (k=1.04 W/mK). The intermediate layer of 25 cm thickness is made of masonry brick (k=0.69 W/mK) followed by a 5 cm thick concrete wall (k=1.37 W/mK). When the furnace is in continuous operation the inner surface of the furnace is at 800°C while the outer concrete surface is at 50°C. Calculate the rate of heat loss per unit area of the wall, the temperature at the interface of the firebrick and masonry brick and the temperature at the interface of the masonry brick and concrete. 15

Section-B

4. An aluminium rod (k=204 W/mK) 2 cm in diameter and 20 cm long protrudes from a wall which is maintained at 300°C. The end of the rod is insulated and the surface of the rod is exposed to air at 30°C. The heat transfer coefficient between the rod's surface and air. Calculate the heat lost by the rod and the temperature of the rod at a distance of 10 cm from the wall.

5. During a heat treatment Process, alloy steel Spherical balls of 12 mm diameter are initially heated to 800°C in a furnace. Subsequently these are cooled to 100°C by keeping them immerged in an oil bath 35°C with convection coefficient 20W/m²–K. Determine the time required for the cooling process. Proceed to calculate the value of convection coefficient if it is desired to complete the cooling process in a period of 10 minute. The physical properties of steel balls are : Density 7750 Kg/m³; Specific heat 520 J/kg-K and conductivity 50 W/m-K ? 15

Section-C

6. Two large parallel planes with emissivities 0.35 and 0.85 exchange heat by radiation. The planes are respectively 1073K and 773 K. A radiation shield having the emissivity of 0.04 is placed between them. Find the percentage reduction in radiation heat exchange and temperature of the shield. 15

7. Explain for fluid flow along a flat plate : 2×7.5=15

(i) Velocity distribution in hydrodynamic boundary layer

(ii) Temperature distribution in thermal boundary layer

Section-D

8. Hot exhaust gases which enters a finned tube cross flow heat exchanger at 300°C and leave at 100°C, are used to heat pressurized water at a flow rate of 1 kg/s from 35 to 125°C. The exhaust gas specific heat is approximately 1000 J/kg.K. and the overall heat transfer co-efficient based on the gas side surface area is U_h=100W/m²K. Determine the required gas side surface area A using the NTU method. 15

Take Cp_c at Tc=80°C is 4197 J/kg.K and Cp_h=1000 J/kg.K.

9. Define effectiveness of a heat exchanger. Derive an expression for the effectiveness of a double pipe parallel flow heat exchanger. State the assumptions made. 15

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B. Tech. (ME) 6th Semester (G Scheme)
Examination, July-2022
DESIGN OF MACHINE ELEMENT-I
Paper-PCC-ME-304-G

Time allowed : 3 hours] *[Maximum marks : 75*

Note : *Attempt **five** questions in all, selecting **one** question from each unit. **Question No. 1 is compulsory**. All questions carry equal marks.*

1. Explain the following : 2.5×6=15

(a) Environment feasibility with example

(b) Function of clutches

(c) Selection of Fits and tolerances

(d) Selection of belt

(e) Thermal considerations in brake designing

(f) Uses of flywheel

Unit-I

(a) What do you mean by feasibility study ? Explain various types of feasibility study in context of design philosophy. 10

(b) Explain brain storming. 5

3. (a) What are the key parameters for selection of engineering materials ? Explain them.

(b) Classify engineering materials.

Unit–II

4. Screw jack is to lift a load of 80 kN through a height of 400 mm. The elastic strength of screw material in tension and compression is 20 MPa and in shear 120MPa. The material for nut is phosphor - bronze for which the elastic limit may be taken as 100 MPa in tension, 90 MPa in compression and 80MPa in shear. The bearing pressure between the nut and screw is not to exceed 18N/mm^2. Design and draw the screw jack. The design should include the design of (i) Screw (ii) Nut, (iii) Handle and cup and (iv) body.

5. Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m diameter subjected to a steam pressure of 0 N/mm^2. Assume joint efficiency as 75% , allowable shear stress in the plate 90 MPa, Compressive stress 140 MPa and shear stress in the rivet 56MPa.

Unit-III

6. (a) What are the factors influencing power transmission through a belt ? Explain. 7

   (b) Derive expression of length for a open belt drive. 8

7. Design a muff coupling which is used to connect two steel shaft transmitting 40 kW at 350 rpm. The material for shaft and key is plain carbon steel for which allowable shear stress and crushing stress may be taken as 40 N/mm^2 and 80N/mm^2 respectively. The material for the cast iron for which the allowable shear stress may be assumed as 15 N/mm^2. 15

Unit-IV

8. A centrifugal clutch is to be designed to transmit 15 kW at 900 rpm. The shoes are four in number. The speed at which engagement begins is 3/4th of the running speed. The inside radius of the pulley rim is 150mm. The shoes are lined with Ferrodo for which coefficient of friction may be taken as 0.25. Determine : (i) Mass of shoes and (ii) Size of the shoes. 15

9. (a) What is self energizing brake ? When a brake become self locking. 7

(b) How does function of brake differs from clutch ? List important factors upon which capacity of brake depends. 8

B. Tech. (ME) 6th Semester (G Scheme)

Examination, July-2022

MANUFACTURING TECHNOLOGY-II

Paper-PCC-ME-302-G

Time allowed : 3 hours] *[Maximum marks : 75*

Note : *Attempt **five** questions in all, selecting at least **one** question from each unit. **Question No. 1 is compulsory.** All questions carry equal marks.*

1. (i) Explain the principles of EDM.

(ii) What is the concept of group technology ?

(iii) Explain the mechanism of chip formation.

(iv) Define absolute and incremental coordinate system.

(v) What do you mean by locating and clamping devices ?

(vi) Explain factors affecting tool life. 6×2.5=15

Unit-I

2. Explain merchant cutting force circle and shear angle relationship in orthogonal cutting. 15

3. Discuss different types of cutting fluids, their properties and selection criteria. 15

Unit-II

4. Differentiate jigs and fixtures. Explain locating principles and methods. 15

5. Explain ECM and ECG on the basis of principles, equipment, dielectric fluid, electrode, process characteristics, advantages and disadvantages. 15

Unit-III

6. Explain in detail CNC and DNC control of machine tool by explaining machining centre with neat and clean diagram. 15

7. Explain part programming procedure in detail with a suitable example. 15

Unit-IV

8. Discuss in detail the concept of group technology in an industry with its components. 15

9. What are the various steps in planning of group technology ? What is group technology layout and what are the advantages of GT layout ? 15