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END SEMESTER EXAMINATIONS, JUNE-2018

PROGRAM : B.TECH.(BME)

SECOND SEMESTER

COURSE CODE : BME109

COURSE TITLE : ENGINEERING MECHANICS

[Time allotted: Three hours]

[Max. Marks: 100]

Note: Attempt all Sections and Questions.

SECTION A

Q. 1. Attempt all questions.

(2 x 10 = 20)

- What do you understand by kinematics?
- Define non-concurrent non-coplanar forces.
- What do you understand by unit vector?
- Define Varignon's theorem.
- Define a free body and free body diagram.
- State and prove Lami's theorem.
- Define center of mass.
- Define moment of Inertia.
- What is the difference between redundant and deficient truss.
- What is the condition for maximum range and maximum height attained by a projectile in projectile motion?

SECTION B

Q. 2. Attempt any 5 questions.

(7 x 5 = 35)

- The resultant of two forces is 400N. If the forces are inclined at 40° and 60° with the resultant, one on either side, calculate the magnitude of the two forces.
- A rope is tied horizontally between two buildings, 30m apart. A weight of 200N is attached to it at its midpoint. Determine the angle the rope would make with the horizontal if the tension developed in the rope is three times the weight of the body. Assume the string to be inextensible and neglect its weight. Also, Determine by how much the weight would sag.
- Two smooth spheres (A & B) each of radius 25 cm and weighing 1000 N, rest in a horizontal channel having vertical walls with width 90 cm. find the reactions at the contact points as shown in the Fig. 1.
- Determine the resultant and direction of four forces concurrent at the origin as shown in Fig. 2.
- A smooth wire is bent into the form of a circle, and is supported by a small ring sliding on it and attached by a string fast to a vertical wall, against which it rests. Determine the inclination of the string to the wall when the tension is double the weight of the circle.
- State the Newton's first and second law of motion. Derive the mathematical expression for Newton's second law of motion
- Determine the centroid of the following structural steel section as shown in Fig.3.

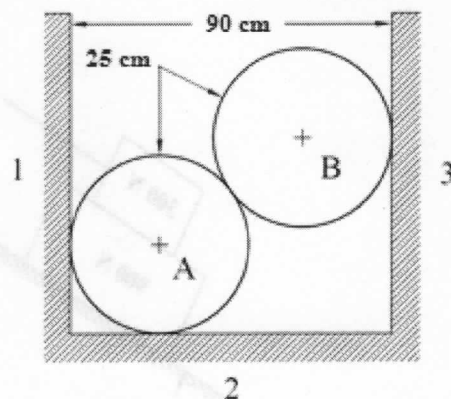


Fig. 1

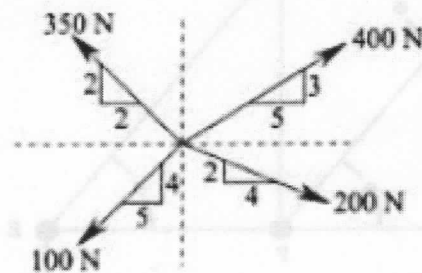


Fig. 2

SECTION C

(15 x 3 = 45)

Attempt **any 3** questions.

- Q. 3. Find the forces in all the members of a truss as shown in the Fig. 4.
- Q. 4. A car of 2 ton mass starts from rest and accelerates at a uniform rate to reach a speed of 60Kmph in 20 seconds. If the frictional resistance is 600 N/ton, determine the driving power of the engine when it reaches a speed of 60kmph.
- Q. 5. A ball is thrown from the top of a building of 20m height with a velocity of 30m/s at an angle of 45° to the horizontal. Determine its velocity at $t=2s$. How high does it rise? Determine the horizontal distance it will travel before striking the ground. Also, determine its velocity at that instant.
- Q. 6. A 10m long uniform ladder weighing 500N is resting on a rough horizontal floor and inclined at an angle of 30° with the vertical wall. A man weighing 800N climbs the ladder up to 4m point, from the ground and along the ladder. The ladder is held in position by another man standing on the ground by applying a horizontal force P at a vertical height, 1.2m from ground level. Determine the force he must apply if the coefficients of friction between the ladder and wall and that between the ladder and floor are 0.2.
- Q. 7. What should be the value of θ in Fig. 5 that will make the motion of 900 N block down the plane to impend? The coefficient of friction for all the contact surfaces is $1/3$.

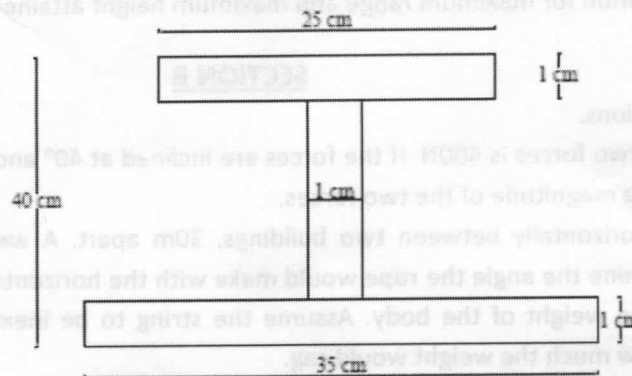


Fig.3

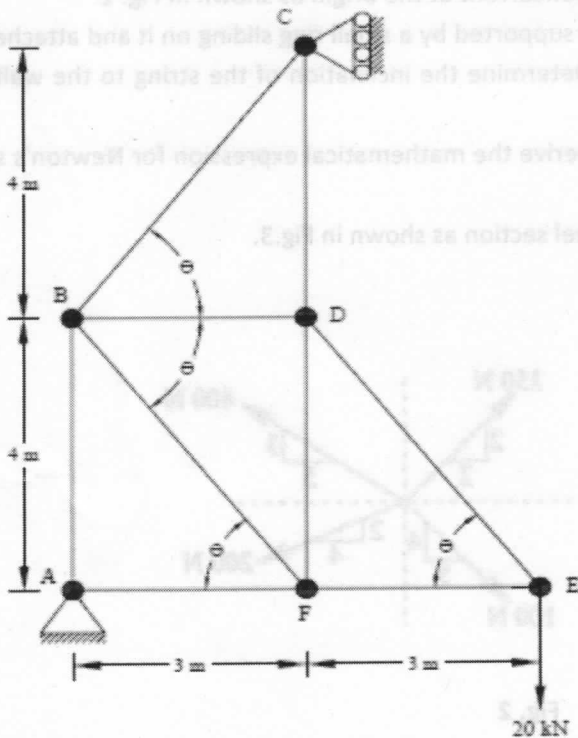


Fig. 4

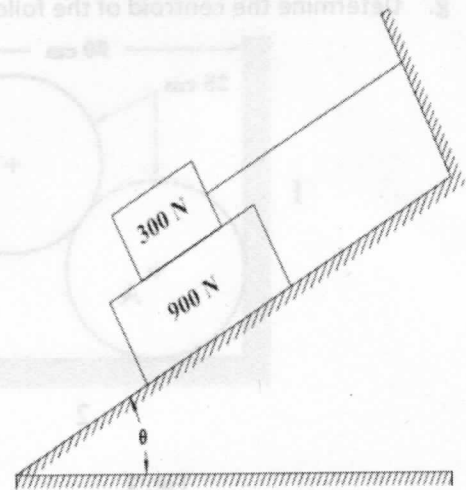


Fig. 5

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END SEMESTER EXAMINATION, JANUARY-2018

PROGRAM : B.TECH.(ME/CE) THIRD SEMESTER

COURSE CODE : CME206/CCE206

COURSE TITLE : STRENGTH OF MATERIALS

[Time allotted: Three hours]

[Max. Marks: 100]

Note: Attempt all Sections & Questions.

Section (A)

(2 x 10 = 20)

Q. 1. Attempt all questions.

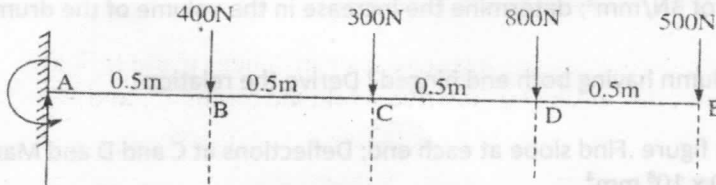
- What do you understand by factor of safety?
- A punch with a diameter equal to 20mm is used to punch a hole in aluminum plate of thickness 4mm. If the ultimate shear stress for the aluminum is 275MPa, what force P is required to punch through the plate?
- Define thermal stresses.
- What do you understand by: Axial Rigidity and True stress?
- Principal planes are those on which Normal stress is _____
- What is twisting stiffness?
- Define the terms: Neutral axis and Neutral surface?
- For a circular column having its ends hinged, the slenderness ratio is 160. The l/d ratio of the column is _____
- Give the relationship of circumferential and longitudinal stresses for thin cylinder.
- Define effective length of column.

Section (B)

(7 x 5 = 35)

Q. 2. Attempt any 5 questions.

- Show that in a strained material subjected to two-dimensional stress, the sum of the normal components of stresses on any two mutually perpendicular planes is constant.
- Following data refers to a tensile test conducted on a mild steel bar.
Diameter of the steel bar=30mm; Gauge length=220 mm; Extension at load 120KN=0.143mm
Load at yield=235 KN; Maximum load=350 KN; Total extension=53mm
Calculate (i) Young's modulus (ii) Yield stress (iii) Ultimate strength (iv) Percentage elongation.
- Draw Shear Force and Bending Moment diagram for following beam



- A steel beam of I section is 600mm deep. Each flange is 250mm wide and 25mm thick. The web is 15mm thick. The beam section is subject to a shear force of 500 KN. Determine the shear stress distribution for the beam section.
- Prove the relation $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$.
- The driving shaft of a truck has an outer diameter of 75mm and an inner diameter of 50mm and it runs at 2500 rpm.
 - If this shaft transmits 300 kW, what is the maximum shear stress in the shaft?
 - If the permissible shear stress is 30N/mm², what is the maximum power that can be transmitted?
- Find the value of slope and deflection at the free end of a cantilever of length L carrying a UDL of w per unit run over the whole length.

Section (C)

Attempt any 3 questions.

(15 x 3 = 45)

Q. 3. a. Construct Mohr's circle for an element in pure shear stress. Find

(7.5)

(i) From the circle derive the following stress transformation equation : $\sigma_{x1} = \tau_{xy} \sin 2\theta$

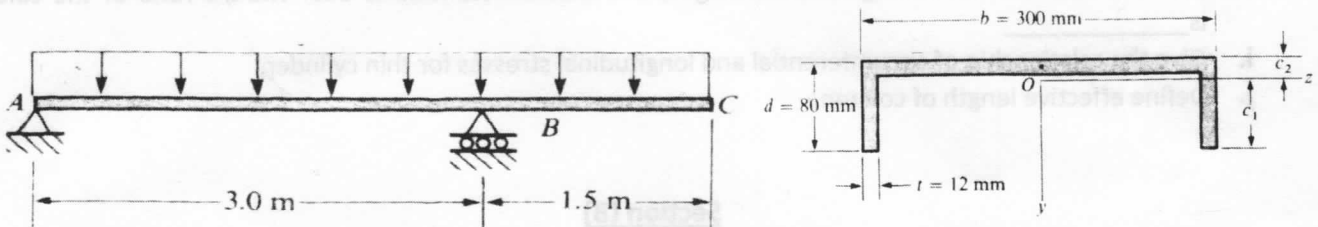
$$\tau_{x1y1} = \tau_{xy} \cos 2\theta$$

(ii) Obtained from the circle principal stresses

(iii) Show from the circle that the maximum and minimum shear stresses are $\pm \tau_{xy}$.

b. A steel rod 18mm in diameter passes centrally through a steel tube 25mm in internal diameter and 30mm in external diameter. The tube is 750mm long and is closed by rigid washer of negligible thickness which are fastened by nut threaded on the rod. The nuts are tightened until the compressive load on tube is 20KN. Calculate the stresses in tube and rod. Find the increase in these stresses when one nut is tightened by one quarter of a turn relative to other. The pitch of threads is 2.5mm. Take $E=200$ GPa. (7.5)

Q. 4. The beam ABC shown in figure with UDL of 6.5 kN/m acts throughout the beam. The beam is constructed from channel section shown in figure. Calculate the maximum tensile and compressive stress in the beam. (15)



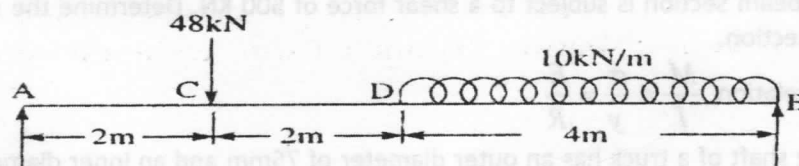
Q. 5. a. A closed-coiled helical spring absorbs 72 N-m of energy when compressed through 60mm. There are 8 coils in the spring. The coil diameter is 10 times the wire diameter. Find the diameters of the coil and wire and maximum shear stress. $G=82$ GPa (7.5)

b. Compare the weight of a solid shaft with that of hollow one to transmit a given power at a given speed with a given maximum shearing stress, the outside diameter of the hollow shaft being 1.5 times internal diameter. (7.5)

Q. 6. a. A hollow cylindrical drum 600 mm in diameter has a thickness of 10 mm and length 3 m. If the drum is subjected to an internal air pressure of 3N/mm^2 ; determine the increase in the volume of the drum. Take $E=2 \times 10^5 \text{ N/mm}^2$ and $\mu=0.3$ (7.5)

b. What is the crippling load for the column having both end hinged? Derive the relation. (7.5)

Q. 7. For a simply supported beam shown in figure. Find slope at each end; Deflections at C and D and Maximum deflection. Take $E=200$ GPa and $I=6.50 \times 10^8 \text{ mm}^4$ (15)



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END SEMESTER EXAMINATIONS, JULY-2018
PROGRAM : B.TECH.(ME) THIRD SEMESTER

COURSE CODE : CME204**COURSE TITLE : MATERIAL SCIENCE IN ENGINEERING****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections & Questions.

SECTION A

(2 x 10 = 20)**Q. 1.** Attempt all questions.

- a. What is Bravis crystal system?
- b. What do you mean by HRC and BHN?
- c. Explain the term engineering curve/stress strain curve?
- d. How alloying is useful?
- e. What is the difference between bronze and brass?
- f. Give composition of gun metal with application.
- g. What is precipitation hardening?
- h. Explain Inconel and stainless steel.
- i. Discuss corrosion resistance effect on metals and its control.
- j. What is application of thermosetting plastics?

SECTION B

(7 x 5 = 35)**Q. 2.** Attempt any 5 questions.

- a. Give the description of crystalline solids and their types.
- b. Give a brief description of various heat treatment processes.
- c. Explain the properties related to poisson ratio, bulk modulus and elastic constants.
- d. Explain various nondestructive tests.
- e. Explain any three stress strain diagram of different material.
- f. What is the significance of tensile test and compressive test in engineering?
- g. Draw the Cupola furnace and name the main points.

SECTION C

(15 x 3 = 45)

Attempt any 3 questions.

- Q. 3.**
 - a. Give the steel classification with applications.
 - b. How does the microstructure change while transformation, draw the design?
- Q. 4.**
 - a. Differentiate between cooling curve and phase diagram.
 - b. Explain Jominy end quench test and hardenability?
- Q. 5.**
 - a. Explain carburizing process of heat treatment.
 - b. What is flam hardening and induction hardening?
- Q. 6.**
 - a. What are conductors, ceramics, composites explain briefly?
 - b. Explain mechanical behavior of polymers and ceramics.
- Q. 7.**
 - a. Give the application of metal/nonmetals/polymers with examples.
 - b. What experiments have you performed in lab, explain any one?

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END SEMESTER EXAMINATION, JANUARY-2018**PROGRAM : B.TECH.(ME) THIRD SEMESTER****COURSE CODE : CME204****COURSE TITLE : MATERIALS SCIENCE IN ENGINEERING****[Time allotted: Three hours]****[Max.Marks:100]****Note:** Attempt all Sections & Questions.**Section (A)****Q. 1.** Attempt **all** questions.**(2 x 10 = 20)**

- a. Explain the purpose of insulator and give its application.
- b. Mention the temperature range of various heat treatment processes.
- c. Give the effect of stress on mild steel specimen.
- d. Differentiate between hyper and hypo eutectoid phases of steel.
- e. What do you understand by polymers? Give examples
- f. Explain the term HRC and BHN with example
- g. Explain structural steel and its importance?
- h. What do you mean by hot working and cold working?
- i. Explain BCC and FCC crystal structure with fig.
- j. What is the difference between annealing and normalizing?

Section (B)**Q. 2.** Attempt **any 5** questions.**(7 x 5 = 35)**

- a. Explain the properties and applications of polymers from engineering/domestic point of view.
- b. Explain fatigue, creep, impact test with its importance in designing.
- c. What are the advantages of nonferrous materials, explain with examples.
- d. Explain the various properties of ceramic and composites materials.
- e. Draw the figure of cupola furnace with all nomenclature.
- f. Discuss annealing and normalizing in detail?
- g. Explain the importance of Iron carbon phase diagram and how it helps in Heat treatment.

Section (C)Attempt **any 3** questions.**(15 x 3 = 45)**

- Q. 3.**
 - a. Explain tensile test and compressive test in detail. (7.5)
 - b. Explain the mechanical properties of engineering materials in detail. (7.5)
- Q. 4.**
 - a. Explain the case hardening process in detail. (7.5)
 - b. Explain the iron carbon diagram transformation in detail. (7.5)
- Q. 5.**
 - a. Explain the cooling curve in detail with diagram. (7.5)
 - b. Explain the tempering process and differentiate between austempering and martempering. (7.5)
- Q. 6.**
 - a. Explain destructive and non-destructive tests for metals. (7.5)
 - b. Explain the classification of steel mentioning the carbon content in detail and the applications of various types of steel? (7.5)
- Q. 7.**
 - a. Discuss the advantages of heat treatment and name all methods. (7.5)
 - b. Explain the various types of nonferrous metals, their properties and applications. (7.5)

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END SEMESTER EXAMINATIONS, JANUARY-2018
PROGRAM: B.TECH. (ME/CE) THIRD SEMESTER

COURSE CODE: CME /CCE203
MECHANICS**COURSE TITLE: FLUID****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections & Questions.

Section (A)

Q. 1. Attempt all questions.**(2 x 10 = 20)**

- a. What is fluid?
- b. State Pascal's law?
- c. Explain briefly the following types of equilibrium of floating bodies with the help of diagramS.
 - i. Stable equilibrium
 - ii. Unstable equilibrium
- d. Distinguish between steady and unsteady flow
- e. Drive the expression $C_d = C_c \times C_v$
- f. Define the following terms:
 - iii. Notch
 - iv. Orifice
- g. What are the difference between a laminar and turbulent flow?
- h. What is an equivalent pipe?
- i. What is loss of head at exit of pipe?
- j. What is non Newtonian flow?

Section (B)

Q. 2. Attempt any 5 questions.**(7 x 5 = 35)**

- a. Derive the relation of momentum thickness for boundary layer flows?
- b. Drive the expression for Meta center height for floating body?
- c. A oil of viscosity 0.98 poise and relative density 0.91 is flowing through a horizontal circular pipe of diameter 100 mm and of length 10 m. Calculate the difference of pressure at the two ends of the pipe, if 100 kg of the oil is collected in a tank in 30 seconds?
- d. Derive the three dimensional continuity equation in Cartesian coordinates?
- e. Derive an expression for the depth of center of pressure from free surface of liquid of a vertical plane surface submerged in the liquid?
- f. A 200 mm x 100 mm Venturimeter is provided in a vertical pipe carrying a water, flowing in the upward direction. A differential mercury manometer connected to the inlet and throat gives reading of 220 mm. find the rate of flow. Assume $C_d = 0.98$?
- g. The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the left is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The center of the pipe is 12 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 20 cm?

Section (C)

Attempt any 3 questions.

(15 x 3 = 45)**Q.3.** A viscous fluid flowing in a pipe. Derive the following relation for

- i. velocity profile
- ii. ratio of maximum velocity to average velocity
- iii. Hagen Poiseuille relation

- Q.4.** a. Define the terms: (i) cohesion and adhesion (iii) surface tension and capillarity (iv) kinematic viscosity and dynamic viscosity? (9)
- b. A fish moves horizontally in sea and has its axis 15 m below the surface of water a pitot tube is placed just in front of the submarine and along its axis it is connected to two limbs of a U-tube manometer containing mercury (Hg) the difference of mercury level is found to be 170 mm and density of sea water is 1.026 times of fresh water then find the speed of fish. (6)
- Q.5.** a. Water is flowing through a pipe of 5 cm diameter under a pressure of 29.43 N/cm^2 (gauge) and with mean velocity of 2 m/s. Find the total head or total energy per unit weight if the water at a cross-section which is 5 m above the datum line? (9)
- b. Derive an expression for discharge over a rectangular notch. (6)
- Q.6.** a. Viscous fluid with the laminar flow is flowing with a maximum velocity of 2m/s between horizontal parallel fixed plates which are 100 mm apart, given $\mu=2.45\text{Ns/m}^2$ determine the (i) pressure gradient (ii) the shear stress at the two horizontal parallel plates and (iii) the discharge per meter width (8)
- b. The diameter of a small piston and a large piston of a hydraulic jack are 3cm and 10cm respectively. A force of 80 N is applied on the small piston. Find the load lifted by the large piston when-
- the pistons are at same level,
 - when small piston is 40cm above the large piston
- (density of the liquid in the jack is given as 1000kg/m^3) (7)
- Q.7.** The discharge Q of a centrifugal pump depends upon the mass density of fluid (ρ), the speed of the pump (N), the diameter of the impeller (D), the monomeric head (H_m) and the viscosity of fluid (μ). Express the relation between Q and other dimensions. (15)

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END SEMESTER EXAMINATION, JANUARY-2018
PROGRAMME : B.TECH.(ME) THIRD SEMESTER

COURSE CODE : CME202**COURSE TITLE : ENGINEERING THERMODYNAMICS****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections & Questions.**Section (A)****Q. 1.** Attempt all questions.**(2 x 10 = 20)**

- a. Define specific heat at constant volume and at constant temperature.
- b. What is the difference between the universal gas constant and a characteristic gas constant?
- c. A heat engine with thermal efficiency of 45% rejects 500 KJ/kg of heat. How much heat does it receive?
- d. State the first law for a closed system undergoing change of state.
- e. Show that the enthalpy of a fluid before throttling is equal to that after throttling.
- f. What is PMM2? Why it's impossible?
- g. What do you understand by the entropy principle?
- h. What do you understand by the degree of superheat and the degree of sub cooling?
- i. Define volume expansivity and isothermal compressibility
- j. Find the specific volume, enthalpy and internal energy of wet steam at 18 bar, dryness fraction 0.9.

Section (B)**Q. 2.** Attempt any 5 questions.**(7 x 5 = 35)**

- a. 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:
 - i. The pump work
 - ii. The turbine work
 - iii. The rankine efficiency
 - iv. The condenser heat flow
 - v. The dryness at the end of expansion

Assume flow rate of 9.5 kg/s.

- b. A reversible heat engine operates between two reservoir at temperatures of 600°C and 40°C. The engine drives a reversible refrigerator which operates between reservoir at temperatures of 40°C and -20°C. The heat transfer to the heat engine is 2000 kJ and the network output for the combined engine refrigerator is 360 kJ.
 - i. Calculate the heat transfer to the heat transfer to the refrigerant and the heat transfer to the reservoir at 400C.
 - ii. Reconsider (i) given that the efficiency of the heat engine and the C.O.P of the refrigerator are each 40 % of their maximum possible values.
- c. Show that the transfer of heat through a finite temperature difference is irreversible.
- d. Explain how the available energy will be decrease when heat is transferred through a finite temperature difference.
- e. A mass of 8 kg gas expands within a flexible container so that the p-v relationship is of the form $pv^{1.2} = \text{constant}$. The initial pressure is 1000 kPa and the initial volume is 1 m³. The final pressure is 5 kPa. If the specific internal energy of the gas decreases by 40 kJ/kg. Find the heat transfer in magnitude and direction.
- f. Why does the free expansion have zero work transfer?
- g. Explain:
 - i. Throttling process,
 - ii. Draw a simple Rankine cycle in T-S diagram.
 - iii. Explain first law of thermodynamics for both cycle and change of state.

Section (C)

Attempt **any 3** questions.

(15 x 3 = 45)

- Q. 3. a.** A system has a heat capacity at constant volume.

$$C_v = AT^2, \text{ Where } A = 0.042 \text{ J/k}^3$$

The system is originally at 200 K, and a thermal reservoir at 100 K is available. What is the maximum amount of the work that can be recovered as the system is cooled down to the temperature of the reservoir? (7.5)

- b.** 0.75 m³ of hydrogen gas is initially at a pressure of 1 bar and temperature 290 K. It is compressed isentropically to 15 bar. Next it is expanded at constant temperature to original volume. Finally heat rejection takes place at constant volume and the gas pressure is restored to original condition of pressure. Find
- Pressure, volume and temperature at the end of each operation.
 - Heat added during isothermal expansion
 - Change of internal energy during each process
- (7.5)

- Q. 4. a.** Derive the Clausius-Clapeyron equation. (9)

- b.** A Closed system of a constant volume experiences a temperature rise of 25°C when a certain process occurs. The heat transferred in the process is 30 kJ. The specific heat at constant volume for the pure substance comprising the system is 1.2 kJ/kg°C, and the system containing of this substance. Determine:
- The change in internal energy
 - The work done.
- (6)

- Q. 5. a.** Show that the adiabatic mixing of two fluids is irreversible (9)

- b.** Explain the operation of a cyclic refrigerator plant with the block diagram. (6)

- Q. 6. a.** In a steady flow apparatus 135 kJ of work is done by each kg of fluid. The specific volume of the fluid, pressure, and velocity at the inlet are 0.37 m³/kg, 600 kPa and 16 m/s. the inlet is 32m above the floor, and the discharge pipe is at floor level. The discharge conditions are 0.62 m³/kg, 100 kPa and 250 m/s. the total heat loss between the inlet and discharge is 9kJ/kg of fluid. In following through this apparatus, does the specific internal energy increase or decrease, and how much? (9)

- b.** Derive the expression of p-dv work for isothermal process. (6)

- Q. 7. a.** Define enthalpy. Why does the enthalpy of an ideal gas depend only on temperature? (6)

- b.** Steam at 20 bar, 360 °C is expanded in a steam turbine to 0.08 bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler:

- Assuming ideal processes, find the network per kg and cycle efficiency.
 - If the turbine and the pump have each 80% efficiency. Find the percentage reduction in the network and cycle efficiency
- (9)

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END SEMESTER EXAMINATIONS, JUNE-2018
PROGRAM : B.TECH.(ME) FOURTH SEMESTER

COURSE CODE : CME205**COURSE TITLE : MANUFACTURING TECHNOLOGY - I****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections and Questions.

SECTION A

Q. 1. Attempt all questions.**(2 x 10 = 20)**

- a. What is the basic difference between Forging and Casting?
- b. Name some parts made out of die casting and centrifugal casting with application.
- c. Name any four allowances provided in pattern and give brief explanation.
- d. What is the difference between blanking and piercing?
- e. Calculate the die and punch size for the washer having, $D=20\text{mm}$, $d=10\text{mm}$, $t=1.5\text{mm}$
- f. Name any two unconventional metal forming processes and explain in brief any one.
- g. Calculate the blanking force required to cut a blank of 60 mm diameter and 2 mm thickness, if the shear strength of the material is 260MPa
- h. What is the importance of clearance in case of die/punch, give any thumb rule to define it.
- i. What is the difference between plastic processing and powder metallurgy processing?
- j. Name two parts each made of powder metallurgy and plastic /polymer and mention the application also.

SECTION B

Q. 2. Attempt any 5 questions.**(7 x 5 = 35)**

- a. What is the difference between hot working and cold working, name any three methods of each.
- b. Name any seven casting defects and explain in brief.
- c. What is powder metallurgy? Explain the process to manufacture carbide bites to be used in milling cutter.
- d. Draw levelled diagram of cupola furnace and which material is produced in this furnace.
- e. What is the function of lubricants? Explain with application.
- f. What is injection moulding and how it differs from blow moulding. Explain with products produced by these methods.
- g. How the presses are classified for sheet metal work and how do they differ from forging hammers?

SECTION C

Attempt any 3 questions.

(15 x 3 = 45)

- Q. 3.**
 - a. Draw the progressive tool to perform blanking and piercing operation
 - b. What are the advantages of die casting and explain hot chamber die casting process.
- Q. 4.**
 - a. Explain jig and fixture and give the advantages of these also how they differ.
 - b. What is the meaning of mass production and how many such processes are known to you? Explain any one of your choice and why?
- Q. 5.**
 - a. Draw a labeled diagram of sand casting process and define core.
 - b. In metal forming explain the role of hot rolling operation and how it is different to other methods.
- Q. 6.**
 - a. Explain wire drawing and tube drawing with figures.
 - b. What is forging and how are the processes classified? Explain any one process of forging operation.
- Q. 7.**
 - a. What is spring back in bending? Explain air bending and edge bending with figure
 - b. What are the different types of pattern and explain any two types used for sand casting.

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END SEMESTER EXAMINATIONS, JUNE - 2018
PROGRAM : B.TECH. (ME) FOURTH SEMESTER

COURSE CODE : CME211**COURSE TITLE : HYDRAULIC MACHINES AND SYSTEMS****[Time allotted: Three hours]****[Max. Marks : 100]****Note:** Attempt all Sections & Questions.**SECTION A****Section (A)****Q. 1.** Attempt all questions.**(2 x 10 = 20)**

- What do you understand by rotodynamic machines?
- Differentiate hydraulic turbines according to head required.
- Explain the principle on which a Kaplan turbine works.
- Why a reciprocating pump called positive displacement pump?
- What is meant by priming?
- Why can the suction lift of a pump cannot exceed a certain limit?
- What is hydraulic intensifier?
- Why the efficiency of a volute casing of a centrifugal pump is low than vortex casing?
- What do you mean by jet propulsion?
- What is the principle of pneumatics?

Section (B)**Q. 2.** Attempt any 5 questions.**(7 x 5 = 35)**

- Show that for a radial vane, the work done per second is given by, : $\rho a V_1 [V_{w1} u_1 \pm V_{w2} u_2]$
- Differentiate between: (a) centrifugal and reciprocating pump (b) radial and axial flow turbines, (c) inward and outward radial flow turbine and (d) Kaplan and propeller turbines?
- A Pelton wheel is revolving at speed of 200 r.p.m and develops 5886 kW (shaft power). When working under a head of 200 m with an overall efficiency of 80%. Determine unit speed, unit discharge and unit power. The speed ratio of turbine is given as 0.48. Find the speed, discharge and power when this turbine is working under a head of 150 m.
- How will you obtain the an expression for the minimum speed for starting a centrifugal pump
- A single acting reciprocating pump, running at 150 mm and stroke length 300 mm. the center of the pump is 4 m above the water surface in the sump. The atmospheric pressure head is 10.3 m of water and pump is running at 40 r.p.m if the length and diameter of the suction pipe are 5 m and 10 cm respectively, determine the pressure head due to acceleration in the cylinder :
 - At the beginning of the suction stroke
 - In the middle of the suction stroke
- Show from first principle that the work saved, against friction in the delivery pipe of a single acting reciprocating pump, by fitting an air vessel is 84.8%, while for a double-acting reciprocating pump the work saved is only 39.20%.
- A the water is supplied at the rate of 3000 litres per minute from a height of 4m to a hydraulic ram, which raise 300 litres/minute to a height of 30 m from the ram. The length of the diameter of the delivery pipe is 100 m and 70 mm respectively. Calculate the efficiency of the hydraulic ram if the co-efficiency of friction $f = 0.009$

Section (C)

Attempt any 3 questions.

(15 x 3 = 45)

- Q. 3. a.** A 137 mm diameter jet of water issuing from a nozzle impinges on the bucket of a Pelton wheel and the jet is deflected through an angle of 165° by the buckets, the head available at the nozzle is 400 m. assuming $C_v = 0.97$, speed ratio is 0.46 and reduction in relative velocity while passing through bucket as 14%, find:
- the force exerted by the jet on buckets in tangential direction
 - the power developed
- (7.5)
- b.** Show that the efficiency of a free jet strike normally on a series of flat plates mounted on the periphery of a wheel can never exceed 50%. (7.5)
- Q. 4. a.** A reaction turbine works at 450 rpm under a head of 120 m. its diameter at inlet is 1.2 m and the flow area is 0.4 m^2 . The angles made by absolute and relative velocities at inlet are 20° and 60° respectively with the tangential velocity. Determine:
- volume flow rate
 - power developed, and
 - hydraulic efficiency
- (7.5)
- b.** A Kaplan turbine develops 9000 kW under a net head of 7.5 m. Mechanical efficiency of the wheel is 86%. The speed ratio based on the outer diameter is 2.2 and the flow ratio is 0.66. Diameter of the boss is 0.35 times the external diameter of the wheel. Determine the diameter of the runner and the specific speed of the runner. (7.5)
- Q. 5. a.** A centrifugal pump impeller runs at 1000 rpm. Its external and internal diameters are 0.50 m and 0.25 m. the vanes are set back at an angle of 35° to the outer rim. If the radial velocity of water through the impeller is maintained 2m/s, calculate:
- The angle of the vanes at inlet
 - The velocity and direction of water at outlet
 - Work done by impeller per kg of water.
- (7.5)
- b.** A four stage centrifugal pump has impellers 380 mm diameter and 19 mm wide at outlet. The outlet vane angle is 45° and the vanes occupy 8% of the outlet area. The Manometric efficiency is 84% and the overall efficiency 72%. Determine the head generated by the pump when running at 900 rpm, and discharging 56 litres/second. Also determine the power required to drive the pump. (7.5)
- Q. 6. a.** A single acting reciprocating pump has a plunger diameter of 250 mm and stroke length of 450 mm and running with 60 rpm. The length and diameter of delivery pipe are 60 m and 100 mm respectively. Determine power saved in overcoming friction in deliver pipe by fitting an air vessel on the delivery side of the pump. Assume friction factor as 0. (7.5)
- b.** A double acting reciprocating pump has a bore of 150 mm and stroke of 300 mm. the suction pipe has a diameter of 100 mm and is fitted with an air vessel. Find the rate of flow into or from the air vessel when the crank makes angles of 30° , 90° and 120° with inner dead center. The speed is 120 rpm and the plunger has simple harmonic motion. (7.5)
- Q. 7. a.** Explain with neat sketch the principle of working of Hydraulic accumulator.
- b.** What do you understand by single and double acting actuator?

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END SEMESTER EXAMINATIONS, JUNE-2018
PROGRAM: B.TECH.(ME) FOURTH SEMESTER

COURSE CODE : CME207**COURSE TITLE : APPLIED THERMODYNAMICS****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections & Questions.

SECTION A

Q. 1. Attempt all questions.**(2 x 10 = 20)**

- a. Define diagram factor.
- b. Explain the difference between higher and lower calorific value of fuel.
- c. If mass of air entering in furnace is 25 kg then what will be the mass of flue gas exit from the furnace if the air fuel ratio is 25:1?
- d. Fill in the blanks: (i) Locomotive boiler is a _____ pressure boiler.
(ii) Critical temperature for water is _____.
- e. What is the main difference between forced and induced draught?
- f. For a low pressure ratio and high quantity of air which compressor is suitable?
- g. For cooling of gas the value of Joule Kelvin co-efficient should be _____ and inlet temperature of gas should be _____ the maximum inversion temperature.
- h. Fill in the blanks: (i) To control the supply of water to boiler _____ is used.
(ii) To protect the boiler against damage due to overheating _____ is used.
- i. Name all 4 thermodynamic processes which take place in Brayton cycle.
- j. The value of dryness fraction for dry and saturated steam is _____ and wet steam is _____.

SECTION B

Q. 2. Attempt any 5 questions.**(7 x 5 = 35)**

- a. Draw a binary vapour cycle, also list out the properties of ideal binary vapour fluid?
- b. (i) Explain nozzle efficiency with the help of a h-s diagram? (ii) Explain the process of supersaturated expansion of steam in a nozzle?
- c. Explain the construction and working of a Lancashire boiler with diagram?
- d. Find out the amount of heat which should be supplied to 5 kg of water at 25 °C temperature to convert it to steam at 6 bar pressure with 0.85 dryness fraction. Also determine the entropy at 6 bar pressure with 0.9 dryness fraction?
- e. What is safety valve? Name all its types and draw and explain lever safety valve.
- f. An oil fuel with a lower calorific value of 44700 KJ is burnt in a boiler with air-fuel ratio as 20:1. Neglecting ash, calculate the maximum temperature attained in the furnace of the boiler. Assume that whole of the heat of combustion is given to the products of combustion and their average specific heat is 1.08 kJ/kg K. Take boiler room temperature as 380°C.
- g. In a steam turbine steam at 20 bar, 350 °C is expanded to 0.08 bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into boiler. Assume ideal process, and draw the cycle in T-S diagram and H-S diagram. Also determine cycle efficiency (Consider pump work and use steam table).

SECTION C

Attempt any 3 questions.

(15 x 3 = 45)

- Q. 3.** a. A steam turbine is fed with steam having an enthalpy of 3100 kJ/kg. It moves out of the turbine with enthalpy of 2100 kJ/kg. Feed heating is done at a pressure of 3.2 bar with steam enthalpy of 2500 kJ/kg. The condensate from a condenser with an enthalpy of 125 kJ/kg enters in to feed water heater. The quantity of bled steam is 11200 kg/h. Find the power developed by the turbine. Assume that the water leaving the feed heater is saturated liquid at 3.2 bar and heater is direct mixing type. (10)
- b. A fuel sample has the following composition by mass: C = 80%, H₂ = 12.75%, O₂ = 1.25%, S = 1%. Calculate the theoretical requirement of oxygen and requirement of air. (5)
- Q. 4.** a. Draw a diagram clearly showing parts of a reciprocating steam engine and explain its working? (7)
- b. Derive the equation for equivalent column of hot air and chimney height with the help of suitable diagram. (8)
- Q. 5.** a. Derive the relation for volumetric efficiency of a reciprocating compressor also explain how efficiency depends on pressure ratio. (7)
- b. Explain the Joule Kelvin effect and draw its related diagram also mention the effect of Joule Thomson coefficient. (8)
- Q. 6.** a. Explain and draw block and T-S Diagram of closed Brayton cycle. (5)
- b. Draw a regenerative steam power cycle with block and T-S diagram. Give energy analyses for H.P and L.P. heaters to find out masses of bled steam. (10)
- Q. 7.** a. Explain any two methods of improving the thermal efficiency of gas turbine cycle with T-S diagram. (5)
- b. A gas turbine unit has a pressure ratio of 6:1 and maximum cycle temperature of 600 °C. The isentropic efficiency of the compressor and turbine are 0.85 and 0.80 respectively. Calculate the power output in kilowatts of an electric generator attached to turbine, when the air enter in compressor at 15 °C at the rate of 16 kg /s (Take Cp=1.005 kJ/kgK and $\gamma=1.414$ for compression process and take Cp=1.11 kJ/kgK and $\gamma=1.35$ for expansion process) (10)

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END SEMESTER EXAMINATION, JUNE - 2018
PROGRAM : B.TECH. (ME) FOURTH SEMESTER

COURSE CODE : CME209**COURSE TITLE : ELECTRICAL MACHINES AND AUTOMATIC CONTROL****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections & Questions.

SECTION A

Q. 1. Attempt all questions.**(2 x 10 = 20)**

- a. Define voltage regulation of a transformer.
- b. Give two applications of auto-transformer.
- c. Draw the internal characteristic of a dc shunt generator.
- d. Draw the torque slip characteristics for a three phase induction motor.
- e. Explain the operating principle of an alternator.
- f. Explain the operating principle of a synchronous motor.
- g. Define Transfer Function.
- h. Define open loop control system.
- i. Define settling time.
- j. Write the D'Alembert equation.

SECTION B

Q. 2. Attempt any 5 questions.**(7 x 5 = 35)**

- a. Evaluate the equivalent circuit parameters from the open circuit and short circuit test on a transformer.
- b. Derive the expression for inductively and conductively transformed KVA in an auto-transformer.
- c. Derive the expression for torque in a dc motor.
- d. Explain the Bode Plot technique used to evaluate the stability of a control system.
- e. Explain the working of an alternator with the help of a diagram.
- f. Define the step, ramp, impulse and parabolic functions.
- g. Show that R, L, C in time domain are replaced by R, sL, 1/sC respectively in frequency domain.
- h. Explain the procedure to find stability of a control system using polar plot.

SECTION C

Attempt any 3 questions.

(15 x 3 = 45)

- Q. 3.**
 - a. Derive the expression for saving of copper in an auto-transformer.
 - b. An autotransformer supplies a load of 3 KW at 115 V and at a power factor of unity. If the primary applied voltage is 230 V, Calculate the power supplied to the load (i) Inductively and (ii) Conductively.
- Q. 4.**
 - a. Explain the constructional features of a dc machine.
 - b. Derive the emf equation of a dc generator.
- Q. 5.**
 - a. Explain the working of an ac servo motor with the help of a diagram.
 - b. Explain the synchronous impedance method to calculate voltage regulation of an alternator.
- Q. 6.**
 - a. Explain the operation of an open loop control system with the help of a diagram.
 - b. Check about the stability of the given system using Routh criterion:-
$$s^4 + s^3 + 2s^2 + 2s + 3$$
- Q. 7.**
 - a. Derive the expression for peak time for a second order control system.
 - b. Explain the Root Locus technique to estimate the stability of a control system.

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END SEMESTER EXAMINATIONS, JUNE - 2018
PROGRAM : B.TECH.(ME) FOURTH SEMESTER

COURSE CODE : CME208**COURSE TITLE : MECHANICAL MEASUREMENT & METROLOGY****[Time allotted: Three hours]****[Max. Marks : 100]****Note:** Attempt all Sections & Questions.

SECTION A

Q. 1. Attempt all questions.**(2 x 10 = 20)**

- a. What do you mean by error and define any two type of error?
- b. Define Calibration?
- c. What do you mean by sensors by defining one of its types?
- d. Write short notes on strain gauges?
- e. Describe seismograph instrument?
- f. What is tolerance and write a short note on its types?
- g. What is fits and write a short note on its types?
- h. Explain 3 wire methods of measuring screw thread ?
- i. What do mean by transmission and absorption dynamometer?
- j. Name the various linear precision instruments used in Measurement?

SECTION B

Q. 2. Attempt any 5 questions.**(7 x 5 = 35)**

- a. What do you mean by sensor? Explain linear variable potentiometer sensor with a neat sketch.
- b. Explain thermocouple and bimetallic thermometer by constructing its diagram.
- c. Explain epicycle gear transmission dynamometer.
- d. Explain unbonded strain gauge by constructing its neat sketch.
- e. What do you mean by vibrations? Explain piezoelectric accelerometers with a neat sketch.
- f. What do you mean by Data acquisition system?. Explaining its parts.
- g. What do you mean by bonded gauge? Give a detail notes on its types.

SECTION C

Attempt any 3 questions.**(15 x 3 = 45)**

- Q. 3.**
 - a. Explain what do you mean by measurement and the measurement categories?
 - b. Explain what do you mean by transducer and LVDT by constructing its diagram?
- Q. 4.**
 - a. Why is McLeod gauge used? Explain its principle and its working with neat sketch.
 - b. Why is Bourden gauge used? Explain its principle and its working with neat sketch.
- Q. 5.**
 - a. Write a detail notes on Pirani gauge and construct a neat diagram.
 - b. Explain the concept of optical Pyrometer with its diagram.
- Q. 6.**
 - a. Calculate all the relevant dimensions of 75H7/f8 fit, dimension 75 mm falls in the step of 50-80mm. The fundamental deviation for 'f' shaft is $-5.5D^{0.41}$ where i is in microns $=0.45(D)^{1/3}+0.001D$, IT7=16i and IT8=25i.
 - b. Describe autocollimator by constructing its diagram.
- Q. 7.**
 - a. Describe the construction, working and theory of an interferometer.
 - b. Explain Tool maker's microscope with neat sketch.

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END SEMESTER EXAMINATIONS, JUNE, 2018
PROGRAM: B.TECH. (ME) FOURTH SEMESTER

COURSE CODE : CME212

COURSE TITLE : I.C.ENGINES

[Time allotted: Three hours]

[Max. Marks: 100]

Note: Attempt all Sections & Questions.

SECTION A

Q. 1. Attempt all questions.

(2 x 10 = 20)

- a. Define the following: (i) Engine and (ii) Heat Engine.
- b. What is meant by TDC and BDC? In a suitable sketch mark the two dead centres.
- c. Why the air injection system not used now days?
- d. Draw the Carnot cycle on P-V and T-S Diagrams.
- e. Define the carburetion?
- f. What are the homogenous and heterogeneous mixtures in I.C engine?
- g. Describe about the particulate emissions.
- h. List various methods available for finding friction power of an engine.
- i. What is difference between direct and indirect combustion chambers?
- j. Briefly explain the chemical structure of petroleum.

SECTION B

Q. 2. Attempt any 5 questions.

(7 x 5 = 35)

- a. Compare 4-stroke and 2-stroke cycle engines. Bring out clearly their relative merits and demerits.
- b. Derive the relation for air fuel ratio for simple carburetor.
- c. What are the various types of combustion chamber used in SI engines?
- d. What are the advantages of air cooling systems?
- e. Explain the method of Morse Test.
- f. Explain the Pressure feed lubrication system.
- g. What are the emissions that comes out of SI engine exhaust?

SECTION C

Attempt any 3 questions.

(15 x 3 = 45)

- Q.3.**
 - a. Derive the expression for the efficiency and mean effective pressure of the diesel cycle? **(12)**
 - b. The cubic capacity of a four stroke over square spark ignition engine is 245 cc. the over square ratio is 1.1. The clearance volume is 27.2 cc. calculate the bore stroke and compression ratio of the engine **(3)**
- Q.4.**
 - a. describe with suitable sketches the following system of a modern's carburetor: **(10)**
 - i. Idling system ii. Accelerating pump iii. Throttle
 - b. Mention the various important qualities of a good ignitions systems. **(5)**
- Q.5.**
 - a. Bring out the clearly the process of combustion in CI Engines and explain the various stages of combustion. **(8)**
 - b. Describe the briefly the MPFI system with neat sketch? **(7)**
- Q.6.**
 - a. Explain the Forced cooling system **(8)**
 - b. Compare SI and CI engine knocking. **(7)**
- Q.7.**
 - a. A four stroke cycle gas engine has bore of 20 cm and stroke of 40 cm. the compression ratio is 6. In a test on the engine the indicated mean effective pressure is 5 bar, the air to gas ratio is 6:1 and the calorific value of the gas is 12 MJ/m³ at NTP. At the beginning of the compression stroke the temperature is 77 °C and pressure 0.98 bar. Neglecting the residual gases i.e volumetric efficiency is 100%, determine the indicated power, the thermal efficiency and relative efficiency of the engine at 250 rpm. **(10)**
 - b. With neat sketch explain the exhaust driven supercharging methods. **(5)**

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END SEMESTER EXAMINATIONS, JULY-2018

PROGRAM : B.TECH.(ME)

FIFTH SEMESTER

COURSE CODE : CME307

COURSE TITLE : HEAT AND MASS TRANSFER

[Time allotted: Three hours]

[Max. Marks: 100]

Note: Attempt all Sections & Questions.

Assume suitable data wherever is required. Use of Heat and mass transfer data book is allowed.

SECTION A

Q. 1. Attempt all questions.

(2 x 10 = 20)

- Explain the process of conduction in metals.
- What do you understand by critical thickness of insulation?
- What is the physical significance of Grashof's no. in heat transfer?
- What is the physical significance of Prandtl no.?
- Explain the term fin effectiveness and fin efficiency.
- What do you understand by film boiling?
- What do you understand by filmwise condensation?
- What do you understand by shape factor?
- What do you understand by Black body and Grey body?
- Explain monochromatic emissive power of a black body.

SECTION B

Q. 2. Attempt any 5 questions.

(7 x 5 = 35)

- A large 3cm thick steel plate ($k=15.1\text{W/mK}$) is generating heat uniformly at the rate of $5 \times 10^6\text{W/m}^3$. Its both sides are exposed to convection to an ambient at 30°C with a heat transfer coefficient of $600\text{W/m}^2\text{K}$. Explain where in the plate the highest and lowest temperature occur, and calculate their values.
- One end of a long rod 3cm in diameter is inserted into a furnace with the outer end projecting into the outside air. Once the steady state is reached the temperature of the rod is measured at two points, 15cm apart and found to be 140°C and 100°C , when the atmospheric air is at 30°C with convection coefficient of $20\text{W/m}^2\text{K}$. Calculate the thermal conductivity of the rod material?
- Steam condensing on the outer surface of a thin-walled circular tube of diameter $D=50\text{mm}$ and length $L=6\text{m}$ maintains a uniform outer surface temperature of 100°C . Water flows through the tube at a rate of $\dot{m}=0.25\text{kg/s}$, and its inlet and outlet temperatures are $T_{m,i}=15^\circ\text{C}$ and $T_{m,o}=57^\circ\text{C}$. What is the average convection coefficient associated with the water flow.
- A flat plate 1m wide and 1.5m long is maintained at 90°C in air with free stream temperature of 10°C flowing along 1.5m side of the plate. Determine the velocity of the air required to have a rate of energy dissipation as 3.75kW .
- In a particular solar collector, energy collected by placing a tube at the focal line of parabolic collector and passing fluid through the tube. The arrangement resulting in a uniform heat flux of 2000W/m^2 along the axis of the tube of diameter 60mm. Determine:
 - length of the tube required to heat the water from 20°C to 80°C which flows at the rate of 0.01kg/s
 - surface temperature at the outlet of tube

- f. Steam in a condenser of a steam power plant is to be condensed at a temperature of 30°C with cooling water from a nearby lake, which enters the tubes of condenser at 14°C and leaves at 22°C. The surface area of the tubes is 45m² and overall heat transfer coefficient is 2100W/m²K. Calculate the mass flow rate of cooling water needed and rate of steam condensation in the condenser.
- g. A furnace cavity, which is in the form of a cylinder of 75mm diameter and 150mm length, is open at one end to large surroundings that are at 27°C. The sides and bottom may be approximated as blackbodies, are heated electrically, are well insulated, and are maintained at temperatures of 1350 and 1650°C, respectively. How much power is required to maintain the furnace conditions?

SECTION C

Attempt any 3 questions.

(15 x 3 = 45)

- Q. 3. The steel ball bearing ($k=50\text{W/mK}$, $\alpha=1.3 \times 10^{-5}\text{m}^2/\text{s}$), 40mm in diameter are heated to temperature of 650°C. It is then quenched in a oil bath at 50°C, where the heat transfer coefficient is estimated to be 300W/m²K. Calculate:
- the time required for bearing to reach 200°C
 - the total amount of heat removed from a bearing during this time
 - the instantaneous heat transfer rate from the bearings, when they are first immersed in oil bath and when they reach 200°C
- Q. 4. Air at 20°C and at atmospheric pressure, flows at a velocity of 4.5m/s, past a flat plate with a sharp leading edge. The entire plate surface is maintained at a temperature of 60°C. Assuming that the transition occurs at $Re=5 \times 10^5$, find the distance from the leading edge, at which the flow in the boundary layer changes from laminar to turbulent, at this location calculate:
- Thickness of hydrodynamic and thermal boundary layers
 - Local and average heat transfer coefficients
 - Heat transfer rate from both sides for unit width of the plate
 - The skin friction coefficient
- Q. 5. a. A tube 13mm in outer diameter and 1.5m long is used to condense the steam at 40kpa ($T_{sat}=76^\circ\text{C}$). Calculate the heat transfer coefficient for this tube in
- horizontal position
 - vertical position
- Take average tube wall temperature as 52°C (7.5)
- b. Explain the pool boiling phenomenon with suitable diagram showing the various boiling regime. (7.5)
- Q. 6. A counter flow double pipe heat exchanger using superheated steam is used to heat the water at a rate of 3kg/s. the steam enters the exchanger at 180°C and leaves at 130°C. The inlet and exit temperature of water are 30°C and 80°C, respectively. The overall heat transfer coefficient is 820W/m²K. Calculate the heat transfer area required. What would be the increase in surface area, if fluids flow in parallel? Take C_p of water as 4.187kJ/kgK.
- Q. 7. a. Two parallel, infinite gray surfaces are maintained at temperature of 127°C and 227°C respectively. If the temperature of the hot surface is increased to 327°C by what factor is the net radiation exchange per unit area increased? Assume the emissivities of colder and hotter surfaces to be 0.9 and 0.7, respectively. (10)
- b. Explain the following terms: (5)
- Emmissivity
 - Reflectivity
 - Transmissivity
 - Radiosity
 - View factor

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END SEMESTER EXAMINATIONS, JANUARY-2018
PROGRAM : B.TECH. (ME) FIFTH SEMESTER

COURSE CODE : CME305**COURSE TITLE : MANUFACTURING TECHNOLOGY-II****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections & Questions.

Section (A)

Q. 1. Attempt **all** questions.**(2 x 10 = 20)**

- a. What is speed, feed and depth of cut in Lathe?
- b. What is indexing? Suggest indexing to cut square head bolt in milling.
- c. What is broaching and where it is required?
- d. What are the advantages of NC/CNC machine tools?
- e. How the milling machines are classified and how it differs from drilling?
- f. Give full form of EDM, ECM, USM, LBM and what energy source is used by them.
- g. What are various taper turning methods? Define any one.
- h. Name any four accessories used in each machine i.e. Lathe and Milling.
- i. Find out the RPM to turn a C40 shaft of 60 mm diameter in Centre lathe, if the cutting speed is 40m/min.
- j. Find out the change gear to cut 10 t.p.i. with a center lathe of 4 t.p.i. lead screw, if machine have gear set from 20 T to 120 T....

Section (B)

Q. 2. Attempt **any 5** questions.**(7 x 5 = 35)**

- a. What are the properties of cutting fluids and why they are used?
- b. Name any 10 turning operations and explain in brief, any 5 with fig.
- c. Find out taper angle for a shaft, if L=100mm, D= 90mm d= 80 mm, show it by fig also.
- d. Name different type of grinding wheel and draw the shapes generally used.
- e. Draw line diagram of Milling machine and differentiate between up milling and down milling.
- f. How the drilling machine is specified? Draw the figure of drill bit with nomenclature.
- g. Explain EBM and LBM with figure and their specific applications.

Section (C)

Attempt **any 3** questions.**(15 x 3 = 45)**

- Q. 3.**
 - a. Differentiate between welding, soldering and brazing with examples and explain soldering.
 - b. Name any two newer methods of welding and explain any one with application.
- Q. 4.**
 - a. Explain centerless grinding machine with figure and its advantages.
 - b. What are the properties of cutting tool material, state 18:4:1 HSS, name all the cutting tool materials?
- Q. 5.**
 - a. Find out the gear train to cut metric thread of 1 mm pitch in a lathe having lead screw of 6 mm pitch. Explain the change gear mechanism in lathe.
 - b. How the machining time is calculated in turning, drilling, milling and shaper?
- Q. 6.**
 - a. Explain wheel marking system, if marked as: A-46-K-5-V
 - b. What is the difference between shaper and planer? Name any six main parts of shaper with function.
- Q. 7.**
 - a. Draw the figure of single point cutting tool & explain tool signature as: 7-10-8-6-8-14-2
 - b. What is principle of resistance welding? Differentiate between spot welding and seam welding.

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END SEMESTER EXAMINATION, JANUARY-2018
PROGRAM: B.TECH.(ME) FIFTH SEMESTER

COURSE CODE : CME303**COURSE TITLE : DESIGN OF MACHINE ELEMENTS-I****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections & Questions.

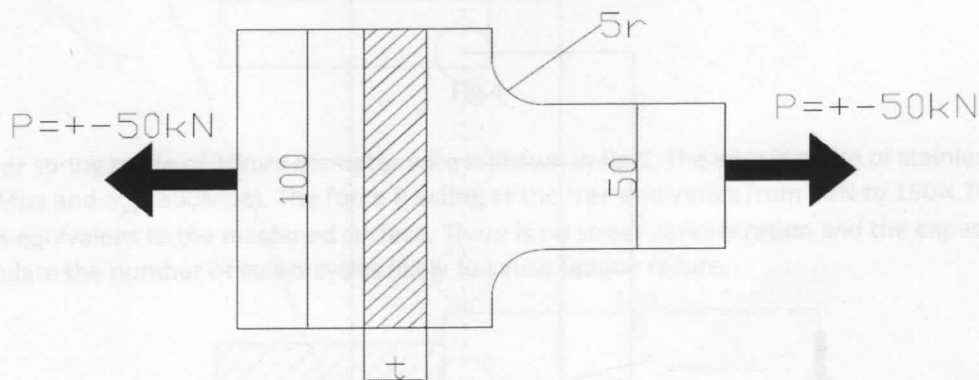
(Use of design data book is allowed. And assume suitable data wherever is required)

Section (A)**Q. 1.** Attempt all questions.**(2 x 10 = 20)**

- Write a short note on the need analysis?
- What do you understand by Ergonomic considerations in design?
- What do you understand by de-rating factors?
- What do you understand by endurance limit of a machine element?
- What is the advantage and disadvantage of trapezoidal thread screw over square thread screw?
- Define overhauling of the screw.
- What do you understand by primary and secondary shear stress in eccentrically loaded bolted joints in shear?
- What do you understand by bearing stress?
- What is the difference between shearing and tearing failure of a machine element?
- What do you understand by crushing failure of key?

Section (B)**Q. 2.** Attempt any 5 questions.**(7 x 5 = 35)**

- It is required to standardize load-carrying capacities of a crane in a manufacturing unit. The maximum and minimum capacities of such Cranes are 1ton and 10 ton, respectively. The company is interested in developing seven models in this range. Specify their load lifting capacities in ton.
- Two rods, made of plain carbon steel ($\sigma_{yt}=380\text{Mpa}$), are to be connected by means of a cotter joint. The diameter of each rod is 50mm and the cotter is made from a steel plate of 15mm thickness. Calculate the dimensions of the socket end making the following assumptions: (a) the yield strength in compression is twice of the tensile yield strength, and (b) the yield strength in shear is 50% of the tensile yield strength. Take factor of safety 5.
- A component machined from a plate made of steel 45C8 ($\sigma_{ut}=630\text{Mpa}$) is shown in fig.1. It is subjected to a completely reversed axial force of 50kN. The expected reliability is 90% and the factor of safety is 2. The size factor is 0.85. Determine the plate thickness 't' for infinite life, if the notch sensitivity factor is 0.8.

**Fig.1**

- The lead screw of a lathe has single-start ISO metric trapezoidal thread of 52 mm nominal diameter and 8mm pitch. The screw is required to exert an axial force of 2kN in order to drive the tool carriage during turning operation. The thrust is carried on a collar of 100mm outer diameter and 60mm inner diameter. The values of coefficient of friction at the screw threads and the collar are 0.15 and 0.12 respectively. The lead screw rotates at 30rpm. Calculate (a) The power required to drive the lead screw (b) The efficiency of the screw.

- e. A wall bracket is attached to the wall by means of four identical bolts, two at A and two at B, as shown in fig.2. Assuming that the bracket is held against the wall and prevented from tipping about the point C by all four bolts and using an allowable tensile stress in the bolts as 35Mpa, determine the size of the bolts on the basis of maximum principal stress theory.

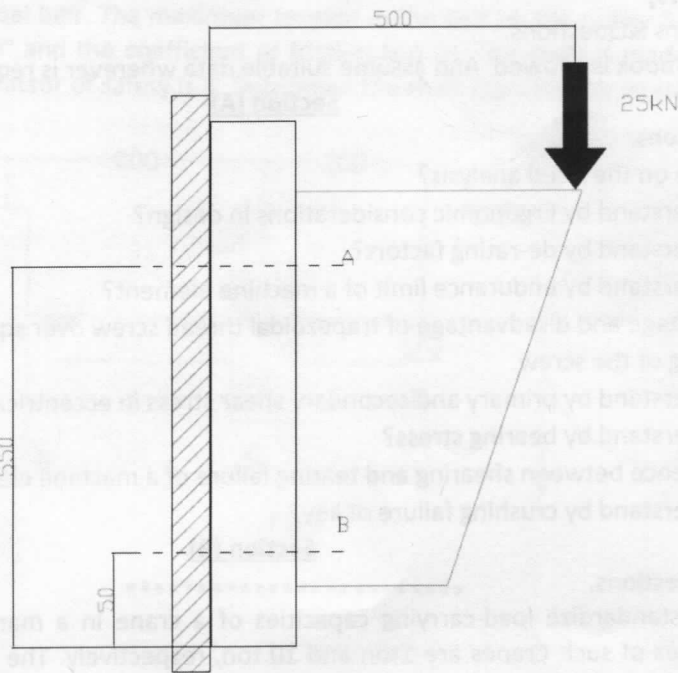


Fig.2

- f. A bracket, attached to a vertical column by means of four identical rivets, is subjected to an eccentric force of 25kN as shown in fig.3. Determine the diameter of rivets, if the permissible shear stress is 60Mpa.

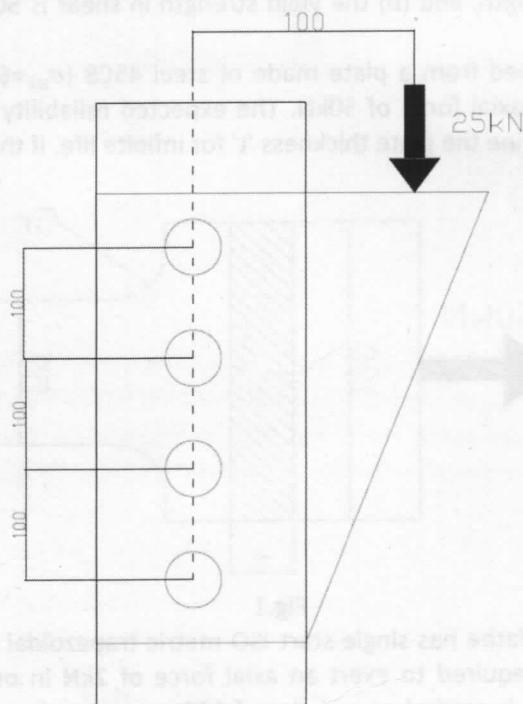


Fig.3

- g. A flat key is used to connect a pulley to a 45mm diameter shaft. The standard cross section of the key is 14x9mm. The key is made of commercial steel ($\sigma_{yt} = \sigma_{yc} = 230\text{Mpa}$) and the factor of safety is 3. Determine the length of the key on the basis of shear and compression considerations, if 15kW power at 360rpm is transmitted through the keyed joint.

Section (C)

(15 x 3 = 45)

Attempt any 3 questions.

- Q.3. It is required to design a knuckle joint to connect two circular rods subjected to an axial tensile force of 50kN. The rods are co-axial and a small amount of angular movement between their axes is permissible. Design the joint and specify the dimensions of its components. Take factor of safety 5 for all elements and $\sigma_{yt} = \sigma_{yc} = 400\text{Mpa}$ for plain carbon steel.
- Q.4. Design a muff coupling to connect two steel shafts transmitting 25kW power at 360rpm. The shafts and key are made of plain carbon steel 30C8 ($\sigma_{yt} = \sigma_{yc} = 400\text{Mpa}$). The sleeve is made of grey cast iron FG200 ($\sigma_{ut} = 200\text{Mpa}$). The factor of safety for the shafts and key is 4. For the sleeve, the factor of safety is 6 based on ultimate strength.
- Q.5. A welded connection, as shown in fig.4, is subjected to an eccentric force of 60kN in the plane of the welds. Determine the size of the welds, if the permissible shear stress for the weld is 100Mpa. Assume static conditions.

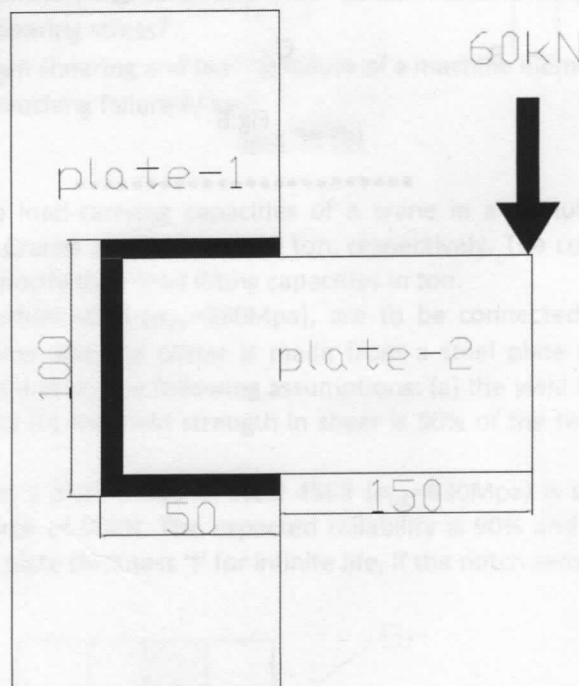


Fig.4

- Q.6. A cantilever spring made of 10mm diameter wire is shown in fig.5. The wire is made of stainless steel 4Cr18Ni10 ($\sigma_{ut} = 860\text{Mpa}$ and $\sigma_{yt} = 690\text{Mpa}$). The force P acting at the free end varies from 75N to 150N. The surface finish of the wire is equivalent to the machined surface. There is no stress concentration and the expected reliability is 50%. Calculate the number of stress cycles likely to cause fatigue failure.

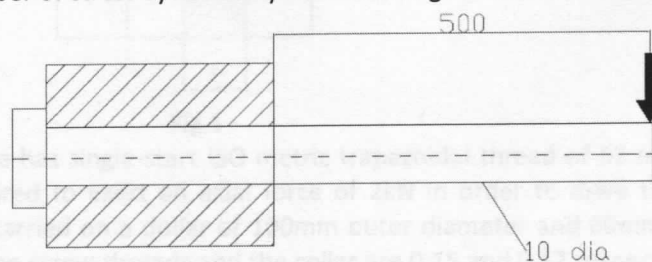


Fig.5

- Q.7.** The layout of a transmission shaft carrying two pulleys B and C and supported on bearings A and D is shown in Fig. 6. Power is supplied to the shaft by means of a vertical belt on the pulley B, which is then transmitted to the pulley C carrying a horizontal belt. The maximum tension in the belt on the pulley B is 2.5 kN. The angle of wrap for both the pulleys is 180° and the coefficient of friction is 0.24. The shaft is made of plain carbon steel 30C8 ($\sigma_{yt}=400\text{N/mm}^2$) and the factor of safety is 3. Determine the shaft diameter on strength basis.

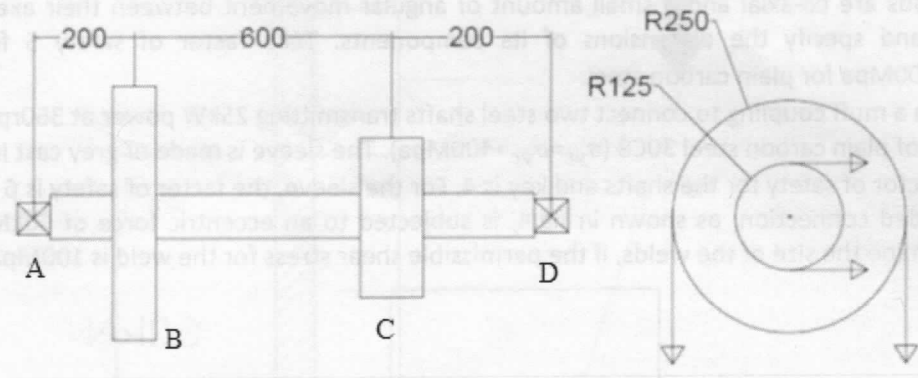


Fig.6

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END SEMESTER EXAMINATION, JANUARY-2018**PROGRAM : B.TECH.(ME) FIFTH SEMESTER****COURSE CODE : CME309****COURSE TITLE : PRODUCTION PLANNING AND CONTROL****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections & Questions.**Section (A)****Q. 1.** Attempt **all** questions.**(2 x 10 = 20)**

- a. Define JIT production system with suitable examples.
- b. In production system what is the importance of aggregate planning.
- c. What is the importance of Gantt chart?
- d. What is the importance ERP?
- e. Explain product planning function with respect to MRP II.
- f. Mention any four causes of poor inventory control.
- g. What is importance of sequencing in PPC?
- h. What is the difference between variable cost and fixed cost, give examples of both?
- i. For any production unit what is the importance of break-even point?
- j. Define product cycle.

Section (B)**Q. 2.** Attempt **any 5** questions.**(7 x 5 = 35)**

- a. What is the difference between Mass production and batch production, explain with examples.
- b. Explain KANBAN system.
- c. Explain method study and its objectives as well as its procedure.
- d. Why expediting is required in any product /service sector and how does it influence the scheduling?
- e. What factors affect the product design and how it is useful for PPC point of view?
- f. What are the principles of product development, and why it is necessary in manufacturing system?
- g. PPC is considered the back bone for profit obtaining, if agreed justify with examples.

Section (C)Attempt **any 3** questions.**(15 x 3 = 45)**

- Q.3.**
 - a. Explain the different aspects of product design required for product analysis.
 - b. What are the benefits of JIT philosophy and what are its main elements?
- Q.4.**
 - a. Why inventory control is required, explain any three inventory resources with examples?
 - b. What is A-B-C analysis, explain with examples.
- Q.5.**
 - a. What is E.O.Q? Derive an expression for the economic order quantity when the stock replenishment is instantaneous.
 - b. What are the different waste in JIT system, explain any two.
- Q.6.**
 - a. What are the various information collecting techniques and how these information are recorded.
 - b. How is the JIT system implemented? Is it successful with Indian context?
- Q.7.**
 - a. Briefly explain the procedures in method study.
 - b. What is the importance of production planning and control?

END SEMESTER EXAMINATION, JANUARY-2018

PROGRAM : B.TECH.(ME) FIFTH SEMESTER

COURSE CODE : CME308

COURSE TITLE : KINEMATICS OF MACHINES

[Time allotted: Three hours]

[Max. Marks: 100]

Note: Attempt all Sections & Questions.

Section (A)

Q. 1. Attempt all questions.

(2 x 10 = 20)

- What is the difference between kinematics and dynamics?
- What is redundant degree of freedom of a mechanism? How are the degree of freedom and the number of joints in a linkage can be found when the number of links and the number of loops is a kinematic chain are known?
- Define Grashof's law. State how is it helpful in four-link mechanisms.
- What is Kennedy's theorem? How is it helpful in locating various instantaneous centres of a mechanism?
- What is relative instantaneous centre?
- Discuss various types of cams.
- Define trace point, pitch circle, base circle, pitch curve & pressure angle.
- Explain the phenomena of 'slip' and 'creep' in a belt drive.
- What do you mean by interference and undercutting?
- What is simple, compound & reverted gear train? Explain with the help of sketches?

Section (B)

Q. 2. Attempt any 5 questions.

(7 x 5 = 35)

- Explain Elliptical Trammel & Scotch Yoke Mechanism in detail with suitable diagrams.
- For the kinematic linkages shown in Fig. 1 & Fig. 2, find the number of binary links (N_b), ternary links (N_t), other links (N_o), total links (N), loops (l), lower pairs (P_1) and degree of freedom.
- The mechanism of a wrapping machine as shown in Fig. 3, has the following dimensions: $O_1A = 100\text{mm}$, $AC = 700\text{mm}$, $BC = 200\text{mm}$, $O_3C = 200\text{mm}$, $O_2E = 400\text{mm}$, $O_2D = 200\text{mm}$ & $BD = 150\text{mm}$. The O_1A rotates at a uniform speed of 100 rad/s . Find the velocity of the point B, D & E by I-Center Method.
- In uniform acceleration and deceleration motion of follower, derive an expression for maximum velocity and acceleration.
- A casting weighs 8 kN and is freely suspended from a rope which makes 2.5 turns round a drum of 200 mm diameter. If the drum rotates at 40 rpm , determine the force required by a man to pull the rope from the other end of the rope. Also, find the power to raise the casting. The coefficient of friction is 0.25 .
- Determine the minimum number of teeth required on a pinion, in order to avoid interference which is to gear with:
 - A wheel to give a gear ratio 4 to 1 .
 - An equal wheel.The pressure angle is 30° and a standard addendum of 1 module for the wheel may be assumed.
- Explain reverted gear train and its applications with suitable examples. Write an expression for speed ratio of simple and reverted gear train. Why we use Idler gears in gear train. Elaborate.

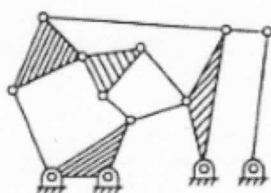


Fig. 1

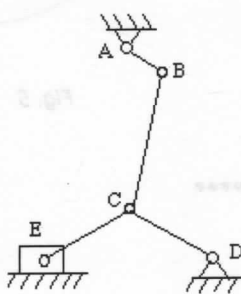


Fig. 2

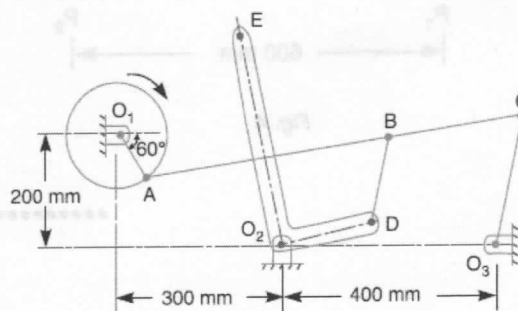


Fig. 3

Section (C)

(15 x 3 = 45)

Attempt any 3 questions.

Q.3. In a crank and slotted lever quick return motion mechanism, the distance between the fixed centres is 240 mm and the length of the driving crank is 120 mm . Find the inclination of the slotted bar with the vertical in the extreme position and the time ratio of cutting stroke to the return stroke.
If the length of the slotted bar is 450 mm , find the length of the cutting stroke if the line of cutting stroke passes through the extreme positions of the free end of the lever.

Q.4. The dimensions and configuration of the four bar mechanism as shown in Fig. 4 with their dimensions. The crank P_1A has an angular velocity of 10 rad/s and an angular acceleration of 30 rad/s^2 both clockwise. Determine the angular velocities and angular acceleration of P_2B & AB . Also, find the velocity and acceleration of joint B.

Q.5. A CAM is to give the following motion to knife-edged follower:
 ➤ To raise the follower through 30 mm with uniform acceleration and deceleration during 120° rotation of the CAM.
 ➤ Dwell for next 30° of the CAM rotation.
 ➤ To lower the follower with simple harmonic motion during the next 90° rotation of the CAM.
 ➤ Dwell for the rest of the CAM rotation.

The CAM has a minimum radius of 30 mm and rotates CCW at a uniform speed of 800 rpm . Draw the profile of the CAM if the line of stroke of the follower passes through the axis of the CAM shaft. Also calculate the maximum value of velocity and acceleration during the rise and return stroke of the follower.

Q.6. Derive an expression for minimum number of teeth in order to avoid the interference at the pinion.

Q.7. An epicyclic gear train consists of three gears A, B and C as shown in Fig. 5. The gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried out on an arm EF which rotates about the centre of A at 18 rpm . If the gear A is fixed, determine the speed of gears B and C.

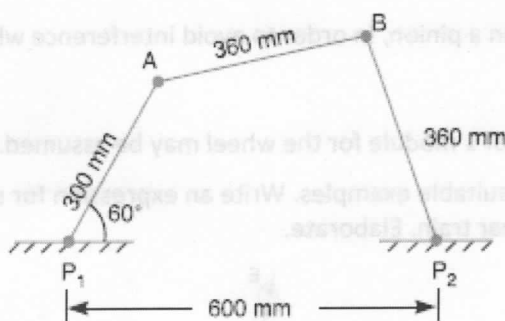


Fig. 4

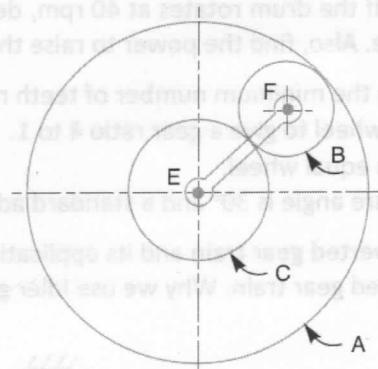


Fig. 5

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END SEMESTER EXAMINATION, JUNE - 2018
PROGRAM : B.TECH. (ME) SIXTH SEMESTER

COURSE CODE : CME312**COURSE TITLE : REFRIGERATION AND AIR CONDITIONING****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections & Questions.

SECTION A

Q. 1. Attempt **all** questions.**(2 x 10 = 20)**

- a. Air compressors have a pressure ratio of 4. If initial pressure is 1 bar and temperature is 15°C then what will be the temperature if compressor works on reversible adiabatic process?
- b. What do you understand by subcooling?
- c. What are the various methods of improving COP of a vapour compression cycle?
- d. Define refrigerant.
- e. Define sensible heat factor.
- f. Explain the following
 - i. wet bulb temperature
 - ii. moist air
- g. Draw the symbol of :
 - i. vapour compressor
 - ii. flash chamber
- h. Why does the temperature of refrigerant decrease on decreasing the pressure during throttling process.
 - i. What is relative humidity?
- j. What do you mean by 1 ton of refrigeration?

SECTION B

Q. 2. Attempt **any 5** questions.**(7 x 5 = 35)**

- a. Explain and draw a Bell-Coleman air refrigeration cycle with T-S and P-V diagram.
- b. Draw and explain a vapour compression refrigeration with T-S and P-V diagram.
- c. In an open type of air refrigeration installation, 1000 kg of atmospheric air circulated per hour. The air is drawn from the cold chamber at temperature 7°C and 1 bar and then compressed isentropically to 5 bar. It is cooled at this pressure to 27°C and then led to expansion where it expands isentropically down to atmospheric and is discharged to the cold chamber. Find the following:
 - i. Heat rejected from cold chamber per hour
 - ii. Heat rejected to cooling water per hour
 - iii. C.O.P. of the system (take air $C_p = 1 \text{ kJ/kg K}$ and $\gamma = 1.4$)
- d. A simple refrigeration plant gives 10 tons of refrigeration using R-12 as refrigerant. The condensing and evaporation temperature are 30°C and -5°C. The refrigerant leaves the evaporator at 0°C. Volumetric efficiency of compressor is 80%. Find out:
 - i. Mass flow rate
 - ii. Power required to run the compressor
 - iii. COP of the system (Assume no losses and no sub cooling of the refrigerant)
- e. Present the following vapour compression refrigeration processes in P-V diagram:
 - i. Vapour is dry at the suction end
 - ii. Vapour is superheated at the suction end and liquid is sub cooled before throttling
 - iii. Wet compression
- f. List the comparison between forced and induced draught tower.
- g. Explain summer air conditioning system for hot and dry air outside condition with the help of diagram.

SECTION C

Attempt any 3 questions.

(15 x 3 = 45)

- Q. 3.** a. Explain and draw a Boot-Strap evaporative type air conditioning system. Also draw its T-S diagram. (6)
- b. An ammonia refrigerator works between -6.7°C and 26°C . The vapour is dry saturated at the end of compression. Calculate:
- Theoretical COP
 - Power required to drive the compressor if cooling capacity of refrigerator is 5 ton.

Use the following properties of ammonia.

Saturation temperature ($^{\circ}\text{C}$)	Specific Enthalpy (kJ/kg)		Specific Entropy (kJ/kg K)	
	h_f	h_g	S_f	S_g
-6.7	-29.26	1262.36	0.1087	4.7401
26.7	124.56	1291.62	0.4264	4.3263

- Q. 4.** a. What is food preservation? Explain the various methods of food preservation in brief. (6)
- b. An air-refrigeration working on Bell-Coleman cycle takes air into the compressor at 1 Bar and -5°C . It is compressed in the compressor to 5 bar and cooled to 25°C at the same pressure. It is further expanded in the expander to 1 bar and discharged to take the cooling load. The isentropic efficiency of the compressor is 85%, isentropic efficiency of expander is 90%. (take $\gamma=1.4$, $C_p=1\text{ kJ/kg K}$ and $C_v=0.7\text{ kJ/kg K}$ for air). Find out the following :
- refrigeration capacity of system if air circulation is 40 kg /min
 - power required in KW to run the system
 - C.O.P of the system .

- Q. 5.** a. Explain two methods of improving the COP of vapour compression refrigeration by under cooling the liquid refrigerant with the help of block and T-S diagram.g (6)
- b. A compressor with 10cm X10cm single acting twin cylinder is used in a refrigeration plant which is working between 38°C and 4°C . The speed of compressor =900 RPM . Compression is isentropic and the refrigerant vapour is just dry saturated when comes out of compressor and refrigerant is saturated liquid when it comes out from condenser. Determine:
- the refrigeration capacity of plant
 - power required to run the compressor if the volumetric efficiency of compressor is 85%
 - COP of the system (Use R-12 as refrigerant)

- Q. 6.** a. Derive the mathematical relation for specific humidity. (4)

- b. Draw a psychometric chart and show various properties. (5)

- c. Explain and draw a single load evaporator with multi-expansion valve and flash chamber with corresponding P-h diagram? (6)

- Q. 7.** a. Explain the effect of pressure losses on the performance of vapour refrigeration cycle with the help of P-h diagram? (7)

- b. Draw and explain a compound compression with flash intercooling with expansion valve and single evaporator with P-h diagram? (8)

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END SEMESTER EXAMINATIONS, JUNE-2018**PROGRAM : B.TECH.(ME / ECE / CSE / CE)****SIXTH SEMESTER****COURSE CODE : HMG306****COURSE TITLE : PRINCIPLES OF MANAGEMENT****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections and Questions.**SECTION A****Q. 1.** Attempt all questions.**(2 x 10 = 20)**

- a. What is/are the method of upgrading the present employees in any organization?
- b. Who is considered as the Father of Scientific Management?
- c. Who categorized the Human need on the basis of Physiological, Safety, Belongingness and Esteem?
- d.is the last but an important step of communication process
- e. Name the branch of management which deals with the financial aspect of any organization.
- f. A.....officer is always taking care of the well being of all the employees working in an organization.
- g. Which mechanism helps in the process of identifying the present level of production of an employee?
- h. Profit = Total.....+ Total Gain – Total.....+ Total Loss
- i. Who coined the famous 14 Principles of Management?
- j. Due to which famous revolution the need for the management was realized?

SECTION B**Q. 2.** Attempt any 5 questions.**(7 x 5 = 35)**

- a. Explain the concept of collective bargaining.
- b. What do you mean by marketing management?
- c. Why is motivation important for any individual?
- d. Explain the process of communication.
- e. What do you understand by selection?
- f. Explain the meaning of organizational behavior.
- g. What do you mean by stress? Explain how it results in the productivity of a worker.

SECTION C

Attempt any 3 questions.

(15 x 3 = 45)

- Q. 3. What is the difference between advertisement & sales promotion? Elaborate the historical background of advertisement.
- Q. 4. Explain the 14 principles of management & scientific management principles. What is the scope & process of management? Explain in detail.
- Q. 5. Differentiate the concept of recruitment & selection and explain the meaning of man power planning.
- Q. 6. Explain how industrial revolution leads to importance & independent study of management.
- Q. 7. Explain in detail the marketing management & marketing mix.

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END SEMESTER EXAMINATIONS, JUNE-2018
PROGRAM : B.TECH.(ME) SIXTH SEMESTER

COURSE CODE : CME311**COURSE TITLE : DYNAMICS OF MACHINES****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections and Questions.

SECTION A

Q. 1. Attempt all questions.**(2 x 10 = 20)**

- a. What is a plane motion and what are its different types? Explain with examples.
- b. State and explain D'Alembert's Principle.
- c. What is static equilibrium? What are the conditions for a body to be in equilibrium under the action of three forces?
- d. What is dynamically equivalent system? Explain.
- e. Discuss how a single revolving mass is balanced by two masses revolving in different planes, when the plane of the disturbing mass lies on one end of the plane of the balancing masses.
- f. What do you mean by unbalance shaking force and a shaking couple?
- g. Discuss the gyroscopic effect on naval ships?
- h. What are different types of a governor? What is the difference watt and porter governor?
- i. Define free vibration, forced vibration and damped vibration.
- j. What is critical speed of a shaft?

SECTION B

Q. 2. Attempt any 5 questions.**(7 x 5 = 35)**

- a. Derive an expression for velocity & acceleration of the piston of a reciprocating engine.
- b. Four masses m_1 , m_2 , m_3 & m_4 are 220 kg, 320 kg, 260 kg & 280 kg respectively. The corresponding radii of rotations are 0.3 m, 0.25 m, 0.35 & 0.4 m respectively and the angles between the successive masses are 55° , 85° & 145° . Find the position and magnitude of the balance mass required, if radius of rotation is 0.3 m.
- c. Find the magnitudes of the resultant unbalanced primary and secondary forces in V-engine.
- d. If the crank and the connecting rod are 300 mm long and 1 m long respectively and crank rotates at a constant speed of 200 rpm. Determine:
 - i. The crank angle at which the maximum velocity occurs.
 - ii. Maximum velocity of the piston.
- e. The turbine rotor of a ship has a mass of 8 tonnes and a radius of gyration 0.6 m. It rotates at 1800 rpm clockwise, when looking from the stern. Determine the gyroscopic couple, if the ship travels at 100 km/hr and steers to the left in a curve of 75 m radius.
- f. A connecting rod is suspended from a point 25 mm above the centre of small end, and 650 mm above its centre of gravity, its mass being 37.5 kg. When permitted to oscillate, the time period is found to be 1.87 seconds. Find the dynamical equivalent system constituted of two masses, one of which is located at the small end centre.
- g. Derive an expression for the natural frequency of free longitudinal vibration by Rayleigh method.

SECTION C

Attempt any 3 questions.

(15 x 3 = 45)

- Q. 3.** A slider crank mechanism with the following dimensions is acted upon by a force $F = 2 \text{ kN}$ at B as shown below. $OA = 100 \text{ mm}$, $AB = 450 \text{ mm}$. Determine the input torque T on the link OA for the static equilibrium of the mechanism for the given configuration.

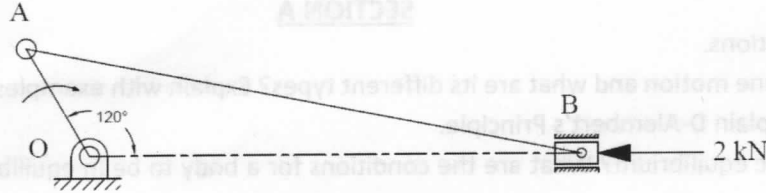


Fig. 2

- Q. 4.** A rotating shaft carries four masses A, B, C & D which are radially attached to it. The mass centres are 30 mm, 38 mm, 40 mm & 35 mm respectively from the axis of rotation. The masses A, C & D are 7.5 kg, 5 kg & 4 kg respectively. The axial distances between the planes of rotation of A & B is 400 mm and between B & C is 500 mm. The masses A & C are right angles to each other. Find for a complete balance:
- The angles between the masses B & D from mass A
 - The axial distance between the planes of rotation of C & D
 - The magnitude of mass B
- Q. 5.** The turbine rotor of a ship has a mass of 2.2 tonnes and rotates at 1800 rpm clockwise when viewed from the aft (stern). The radius of gyration of the rotor is 320 mm. Determine the gyroscopic couple and its effect when the
- Ship turns at a radius of 250 m with a speed of 25 km/hr
 - Ship pitches with the bow rising at an angular velocity of 0.8 rad/s
 - Ship rolls at an angular velocity of 0.1 rad/s
- Q. 6.** The crank pin circle radius of a horizontal engine is 300 mm. The mass of the reciprocating parts is 250 kg. When the crank has travelled 60° from IDC, the difference between the driving and back pressure is 0.35 N/mm^2 . The connecting rod length between the centres is 1.2 m and the cylinder bore is 0.5 m. If the engine runs at 250 rpm and if the effect of piston rod diameter is neglected, calculate:
- Pressure on slide bars
 - Thrust in connecting rod
 - Tangential force on crank pin
 - Turning moment on the crank shaft
- Q. 7.** Derive an expression for the natural frequency of free longitudinal vibration by equilibrium method and energy method.

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END SEMESTER EXAMINATIONS, JUNE - 2018
PROGRAM: B.TECH.(ME) SIXTH SEMESTER

COURSE CODE : CME302**COURSE TITLE : POWER PLANT ENGINEERING****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections & Questions.**SECTION A****Q. 1.** Attempt all questions.**(2 x 10 = 20)**

- a. What is Reserve Factor?
- b. Define Rankine efficiency.
- c. Fill in the blanks:
 - i. _____ Bar is saturation pressure in at 100 °C?
 - ii. Specific volume at 100 °C liquid will be _____ than the specific volume at 100 °C vapour.
- d. What is over feed stoker?
- e. Name any two high pressure boilers.
- f. List any four power generation sources.
- g. Draw a P-V diagram of simple Rankine cycle. (condition of steam at entry is superheated)
- h. What is effect of regeneration in steam power cycle?
- i. Explain:
 - i. Boiler efficiency
 - ii. Turbine efficiency
- j. What do you understand by regeneration?

SECTION B**Q. 2.** Attempt any 5 questions.**(7 x 5 = 35)**

- a. Explain, what is Spreader stoker with diagram and list out its advantages and disadvantages.
- b. Draw and explain the working of spreader stoker.
- c. What is Fluidized Bed combustion? Explain with a suitable diagram.
- d. Explain and draw boiling water reactor with suitable diagram?
- e. In a steam turbine installation running on ideal Rankine cycle, steam leaves the boiler at 10 MPa and 700°C and leaves turbine at 0.005 MPa. For the 50 MW output of the plant and cooling water entering and leaving condenser at 15°C and 30°C respectively determine:
 - i. the mass flow rate of steam in kg/s
 - ii. the thermal efficiency of cycle
- f. What is Electrostatic precipitator? Explain with a suitable diagram.
- g. List the parameters to be considered before selecting a power plant.
- h. A thermal power plant of 210 MW capacity has the maximum load of 160 MW. Its annual load factor is 0.6 the coal consume is 1 kg per kw of energy generated and the cost of coal is 450 rupees per ton, then
 - i. determine the annual revenue earned if energy is sold at Rs 1 per kwh
 - ii. the capacity factor of plant

SECTION C

Attempt any 3 questions.

(15 x 3 = 45)

- Q. 3.** Steam at 40 Bar, 500 °C flowing at the rate of 5500kg/h, expands in a h.p. turbine to 2 bar with an isentropic efficiency of 83 % . A continuous supply of steam at 2 bar, 0.87quality and a flow rate of 2700kg/h is available from a geothermal energy source. This steam is mixed adiabatically with the h.p. turbine exhaust steam and combined flow then expands in a l.p. turbine to 0.1 bar with an isentropic efficiency of 78%. Determine the power output and the thermal efficiency of the plant. Assume that 5500kg/h of steam is generated in the boiler at 40 bar, 500 °C from the saturated feed water at 0.1bar. (15)
- Q. 4.** a. Explain the drawbacks of using water as working fluid in steam power plant. (5)
b. List the advantages and disadvantages of a diesel engine power plant. (10)
- Q. 5.** a. Explain and draw a multi compression with intercooling gas turbine power plant cycle with reheat cycle. (7)
b. What is Pulverised Fuel firing method? List its advantages and disadvantages. (8)
- Q. 6.** a. What is super critical boiler? List the advantages of a super critical boiler. (7)
b. What are the applications of Diesel engines in power field? Explain. (8)
- Q. 7.** a. List the factors which should be considered for site selection of a hydroelectric power plant. (8)
b. Explain the working of Cyclone furnace with a suitable diagram. (7)

SECTION B

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END SEMESTER EXAMINATIONS, JUNE - 2018
PROGRAM: B.TECH. (ME) SIXTH SEMESTER

COURSE CODE : CME304**COURSE TITLE : DESIGN OF MACHINE ELEMENTS - II****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections & Questions.

SECTION A

Q. 1. Attempt all questions.**(2 x 10 = 20)**

- a. What is spring? What are the functions of spring?
- b. What is surge in spring?
- c. Why is the semi-cone angle of a cone clutch made 12.5°?
- d. What is self-energizing block brake?
- e. What are the advantages of disk brake over drum brake?
- f. Why belt drives are called 'flexible drives'? What are its disadvantages?
- g. What are the disadvantages of chain drives?
- h. Define dynamic load carrying capacity of bearing.
- i. What is hydrodynamic lubrication?
- j. Why is the pinion weaker than the gear made of same material?

SECTION B

Q. 2. Attempt any 5 questions.**(7 x 5 = 35)**

- a. A concentric spring consists of two helical compression springs, one inside the other. The free length of the outer spring is 25 mm greater than the inner spring. The wire diameter and mean coil diameter of the spring are 8 and 64 mm respectively. Also, the wire diameter and mean coil diameter of the outer spring are 10 and 80 mm respectively. The number of active coils in inner and outer springs are 10 and 15 respectively. Assume same material for two springs and the modulus of rigidity of spring material is 81370 N/mm². Calculate:
 - i. The stiffness of spring when the deflection is from 0 to 25 mm.
 - ii. The stiffness of spring when the deflection is more than 25 mm.
- b. A centrifugal clutch, transmitting 18.5 kW at 720 rpm, consists of four shoes. The clutch is to engaged at 75% of the running speed. The inner radius of the drum is 165 mm, while the radius of centre of gravity of each shoe, during engaged position is 140 mm. The coefficient of friction is 0.25. Calculate the mass of each shoe.
- c. A mass of 2500 kg is lowered at a velocity of 1.5 m/s from the drum as shown in Fig. 1. The mass of the drum is 50 kg and its radius of gyration can be taken as 0.7 m. On applying the brake, the mass is brought to rest in a distance of 0.5 m. Calculate:
 - i. The energy absorbed by the brake.
 - ii. The torque capacity of the brake.

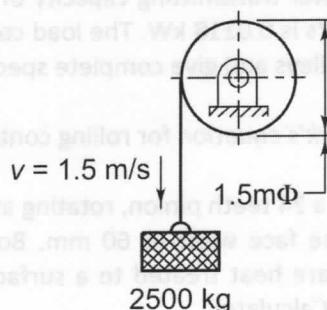


Fig. 1

- d. What are different types of drives? Write the difference between them. What are the advantages and disadvantages of flexible drives? Classify belts based upon the shape of the cross-section with examples.

- e. A ball bearing with a dynamic load capacity of 22.8 kN is subjected to a radial load of 10 kN. Calculate:
- The expected life in million revolutions that 90% of the bearings will reach.
 - The corresponding life in hours, if the shaft is rotating at 1450 rpm.
 - The life that 50% of the bearings will complete or exceed before fatigue failure.
- f. A single stand chain no. 12A is used in a mechanical drive. The driving sprocket has 17 teeth and rotates at 1000 rpm. What is the factor of safety used for standard power rating? Neglect centrifugal force acting on the chain.
- g. A pivoted double-block brake, has two shoes, which subtended an angle of 100° . The diameter of brake drum is 500 mm and the width of the friction lining is 100 mm. The coefficient of friction is 0.2 and the maximum intensity of pressure between the lining and brake drum is 0.5 N/mm^2 . The pivot of each shoe is located in such a manner that the moment of the frictional force on the shoe is zero. Calculate:
- The distance of the pivot from the axis of the brake drum.
 - The torque capacity of each shoe.
 - The reactions at the pivot.

SECTION C

Attempt **any 3** questions.

(15 x 3 = 45)

- Q.3.** A railway wagon moving at a velocity of 2 m/s is brought to rest by a bumper consisting of two helical compression springs arranged in parallel. The springs are compressed by 150 mm in bringing the wagon to rest. The mass of the wagon is 1000 kg. The spring index can be taken as 6. The springs are made of oil-hardened and tempered steel wire with ultimate tensile strength of 1500 N/mm^2 and modulus of rigidity of 81370 N/mm^2 . The permissible shear stress for the spring wire can be taken as 50% of the ultimate tensile strength. Design the springs and calculate:
- Maximum force on each spring.
 - Wire diameter.
 - Mean coil diameter.
 - Number of active coils.
- Q.4.** A cone clutch is used to connect an electric motor running at 1440 rpm with a machine which is stationary. The machine is equivalent to a rotor of 150 kg mass and radius of gyration as 250 mm. The machine has to be brought to the full speed of 1440 rpm from stationary condition in 40 seconds. The semi cone angle is 12.5° . The mean radius of the clutch is twice the face width. The coefficient of friction is 0.2 and the normal intensity of the pressure between contacting surfaces should not exceed 0.1 N/mm^2 . Assuming uniform wear criterion, calculate:
- The inner and outer diameters.
 - The face width of the friction lining.
 - The force required to engage the clutch.
 - The amount of heat generated during each engagement of clutch.
- Q.5.** It is required to select a flat-belt drive for a fan running at 360 rpm which is driven by a 10 kW, 1440 rpm motor. The belt drive is open type and space is available for a centre distance of 2 m approximately. The belt velocity is assumed to be 18 m/s. The power transmitting capacity of the belt per mm width per ply at 180° arc of contact and at a belt velocity of 5.08 m/s is 0.0118 kW. The load correction factor can be taken as 1.2. Suggest preferred diameters for motor and fan pulleys and give complete specifications of belting.
- Q.6.** Derive an expression for *Stribeck's equation* for rolling contact bearing.
- Q.7.** A pair of spur gears consists of a 24 teeth pinion, rotating at 1000 rpm and transmitting power to a 48 teeth gear. The module is 6 mm, while the face width is 60 mm. Both gears are made of steel with an ultimate tensile strength of 450 N/mm^2 . They are heat treated to a surface hardness of 250 BHN. Assume that velocity factor accounts for the dynamic load. Calculate:
- The beam strength.
 - The wear strength.
 - The rated power that the gears can transmit, if service factor and the factor of safety are 1.5 and 2 respectively.

END SEMESTER EXAMINATION, JUNE - 2018
PROGRAM: B.TECH.(ME) SIXTH SEMESTER

COURSE CODE : AMA302**COURSE TITLE : OPERATIONS RESEARCH****[Time allotted: 03 Hours]****[Max. Marks: 100]****Note: Attempt all Sections. Only non-programmable calculators are allowed.**

SECTION A

- Q. 1.** Attempt all parts of this question. **(2×10 = 20)**
- a. Any linear programming problem with multiple optimal solutions has at least _____ CPF solutions that are optimal.
 - b. In Big M method, for the objective function to be maximized, the coefficient of the artificial variables in the objective function is _____.
 - c. If all the elements of pivot column are less than or equal to zero, then the solution is:
(i) Bounded (ii) unbounded (iii) optimal (iv) infeasible
 - d. In game theory, the mixed strategy is a selection among pure strategies with _____ probabilities.
 - e. If the principle of dominance is applicable to the payoff matrix having a saddle point, then the reduced matrix contains _____ elements.
 - f. In a duality theory dual of a dual is again a _____.
 - g. In the optimal solution of transportation problem, more than one empty cells have their opportunity cost as zero, it indicates:
(i) The solution is not optimal (ii) The problem has alternate solution
(iii) Something wrong in the solution (iv) The problem will cycle
 - h. In Hungarian method of solving assignment problem, the row opportunity cost matrix is obtained by:
(i) Dividing each row by the elements of the row above it,
(ii) Subtracting the elements of the row from the elements of the row above it,
(iii) Subtracting the smallest element from all other elements of the row,
(iv) Subtracting all the elements of the row from the highest element in the matrix.
 - i. In general, sequencing problem will be solved by using
(i) Hungarian Method (ii) Simplex method
(iii) Johnson and Bellman method (iv) Flood's technique
 - j. Materials management is a body of knowledge, which helps manager to:
(i) Study the properties of materials (ii) Search for needed material
(iii) Increase the productivity of capital by reducing the cost of material (iv) None of the above

SECTION B

- Q. 2.** Attempt any 5 parts of this questions. **(7×5 = 35)**

- a. Apply Dual Simplex method to find an optimal feasible solution to the given LP

$$\text{Minimize } Z = 6x_1 + 7x_2 + 3x_3 + 5x_4$$

Subject to

$$5x_1 + 6x_2 - 3x_3 + 4x_4 \geq 12$$

$$x_2 + 5x_3 - 6x_4 \geq 10$$

$$2x_1 + 5x_2 + x_3 + x_4 \geq 8$$

$$\text{and } x_1 \geq 0, x_2 \geq 0, x_3 \geq 0, x_4 \geq 0$$

- b. Using Vogel's Approximation Method, find the initial basic feasible solution of the following transportation problem and also find its optimal solution.

	I	II	III	IV	Supply
A	48	60	56	58	140
B	45	55	53	60	260
C	50	65	60	62	360
D	52	64	55	61	220
Demand	200	320	250	210	

- c. A producer has to supply 12,000 units of a product per year to his customer. The demand is fixed and known and backlogs are not allowed. The inventory holding cost is Rs.0.20 per unit per month and the set up cost per run is Rs. 350/- per run. Determine (a) Optimal lot size, (b) Optimum scheduling period, (c) Minimum total expected yearly cost. (d) Optimal number of order.
- d. A car hire company has one car at each of five depots A, B, C, D and E. A customer requires a car in each town P, Q, R, S and T. Distances (in Km.) between depots and towns are given in the following table.

DEPOT → TOWN ↓	A	B	C	D	E
P	160	130	175	190	200
Q	135	120	130	160	175
R	140	110	155	150	185
S	150	50	80	80	110
T	55	35	70	80	105

How car should be assigned to customers so as to minimize the distance traveled.

- e. Using the principle of dominance, find the optimal mixed strategies for both players A & B and also find the value of the game.

		Player B				
		I	II	III	IV	V
Player A	I	3	5	4	9	6
	II	5	6	3	7	8
	III	8	7	9	8	7
	IV	4	2	8	5	3

- f. In a factory, there are seven jobs to process, each of which should go to machines A & B in the order AB. The processing timings in minutes are given, determine the optimal sequencing & total elapsed time. Also calculate the total idle time for the machines in this period.

Jobs	A	B	C	D	E	F	G
Time for A	3	12	15	6	10	11	9
Time for B	8	10	10	6	12	1	3

- g. A small project is composed of nine activities whose time estimates (in hrs) are listed in the following table:

Activity	Optimistic Time (t_o)	Pessimistic Time (t_p)	Most likely Time (t_m)
1-2	5	10	8
1-3	18	22	20
1-4	26	40	33
2-5	16	20	18
2-6	15	25	20
3-6	6	12	9
4-7	7	12	10
5-7	7	9	8
6-7	3	5	4

- Draw the network diagram for the project.
- Find the expected duration & variance of each activity.
- Identify the critical path and expected project completion time.

SECTION C

Attempt any 3 questions.

(15×3 = 45)

- Q. 3. a. Use Two-Phase Simplex method to solve the following LPP

(10)

Minimize $Z = 3x_1 + 2x_2 + 4x_3$

Subject to $2x_1 + x_2 + 3x_3 = 60$

$3x_1 + 3x_2 + 5x_3 \geq 120$

and $x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$

- b. Solve the following game using saddle point to obtain the optimal strategy of for the two players A and B, also compute the value of game, given the pay-off matrix of the player A:

(5)

		Player B				
		I	II	III	IV	V
Player A	I	-2	0	0	5	3
	II	3	2	1	2	2
	III	-4	-3	0	-2	6
	IV	5	3	-4	2	-6

- Q. 4. a. Use Big-M method to solve the following LPP

(10)

Minimize $Z = 3x_1 + 2x_2 + 4x_3$

Subject to $2x_1 + x_2 + 3x_3 = 60$

$3x_1 + 3x_2 + 5x_3 \geq 120$

and $x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$

- b. Write down the Modi's algorithm for the optimal solution of transportation problem.

(5)

- Q. 5. a. Solve the following game graphically to obtain the optimal strategy of for the two players A and B, also compute the value of game, given the pay-off matrix of the player A: (10)

		Player B		
		I	II	III
Player A	I	-2	0	2
	II	3	-1	3
	III	-3	2	3
	IV	5	-4	5

- b. Construct the dual of given LPP model (primal) (5)

Maximize $Z = 5x_1 + 8x_2 + 7x_3$

Subject to $x_1 - 2x_2 + 4x_3 \geq 30$

$2x_1 + x_2 - 3x_3 \leq 20$

$3x_1 - 5x_2 + 4x_3 = 30$

and $x_1 \geq 0, x_2 \text{ unrestricted in sign}, x_3 \leq 0$

- Q. 6. a. A ready-made dress company is manufacturing its seven products through three stages i.e. Cutting, Sewing and Pressing & Packing. The time taken by the products in the Cutting, Sewing and Pressing & Packing process in hours is given below: (10)

Products	I	II	III	IV	V	VI	VII
Cutting Dept.	5	7	3	4	6	7	12
Sewing Dept.	2	6	7	5	9	5	8
Pressing & Packing Process Dept.	10	12	11	13	12	10	11

Find the sequence that minimum the total elapsed time required to complete the jobs. Also calculate the total idle time for the each department in this period.

- b. What is an assignment problem? Describe Hungarian method to solve the problem. (5)

- Q. 7. a. The information related to a project that involves the merger of two online shopping firms Flipkart and Jabong (in days) are given below: (10)

Activity	A	B	C	D	E	F	G	H	I	J
Immediate Predecessor(s)	--	--	A	B	C,D	B	D,F	E	E,G	F,I
Estimated Duration(days)	10	15	5	12	14	8	15	10	6	9

- Draw the network diagram of the project.
- Develop the project schedule (EST, EFT, LST, LFT).
- What are the critical activities?
- What is the project completion duration?
- If there is an option to delay one activity without delaying the entire merge project, which activity would you delay and why?

- b. Define PERT and CPM for network analysis and differentiate between PERT and CPM. (5)

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END SEMESTER EXAMINATIONS, JANUARY-2018
PROGRAM : B.TECH. (ME) SEVENTH SEMESTER

COURSE CODE : CME401**COURSE TITLE: AUTOMOBILE ENGINEERING****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections & Questions.**Section (A)****(2 x 10 = 20)****Q. 1.** Attempt all questions.

- a. Give the classification of IC engine based on number of stroke and method of charging.
- b. Write down the firing order of 4 and 6 cylinder engine.
- c. Why does knocking occur in SI engine?
- d. Give any two advantage of frameless construction over conventional.
- e. State the function of clutch.
- f. Write function of suspension system.
- g. Name the possible cause for noise created by propeller shaft.
- h. What is the need of anti-lock braking system?
- i. How the length of propeller shaft varied automatically.
- j. Why super charging is avoided in SI Engine.

Section (B)**(7 x 5 = 35)****Q. 2.** Attempt any 5 questions.

- a. Draw the chassis layout and explain its significance.
- b. List the various types of spring used in automobile. Explain any one in detail.
- c. Explain briefly with neat sketch the steering linkage for conventional rigid axle system.
- d. Explain the various performance parameters of IC Engine.
- e. Explain the working principle of synchromesh gear box.
- f. What do you understand by transaxle?
- g. Write short note on alternative fuels?

Section (C)**(15 x 3 = 45)**

Attempt any 3 questions.

- Q. 3.**
 - a. Explain the working of simple carburetor with the help of neat sketch. (10)
 - b. State the functions which a piston has to perform in an automobile engine (5)
- Q. 4.**
 - a. Explain various angles involved in steering geometry. (7.5)
 - b. Explain Mac-pherson suspension system. (7.5)
- Q. 5.**
 - a. Explain with suitable sketch the operational features of sliding mesh gear box? (10)
 - b. What are the disadvantages of this type of gear box? (5)
- Q. 6.**
 - a. What is master cylinder? Give the principle of operation with suitable sketch. (10)
 - b. What do you understand by brake bleeding? (5)
- Q. 7.**
 - a. What are the various types of Ignition system? (5)
 - b. Explain contact breaker point ignition system. (10)

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END SEMESTER EXAMINATION, JANUARY-2018
PROGRAM : B.TECH.(ME) SEVENTH SEMESTER

COURSE CODE : CME402**COURSE TITLE : COMPUTER AIDED DESIGN & MANUFACTURING****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections & Questions.

Section (A)

Q. 1. Attempt all questions.**(2 x 10 = 20)**

- a. Define CAD & CAM. What CAD & CAM includes?
- b. Define Database and Software.
- c. Define surfaces of revolution and sweep with diagrams.
- d. How geometry and topology of an object different from each other. Explain.
- e. What is difference between CNC & DNC machines?
- f. What is additive manufacturing? Explain its importance in solid modelling.
- g. What is the difference between process layout and line layout?
- h. What is the difference between manufacturing and flexible manufacturing system?
- i. What is screen size and refresh rate?
- j. What are functions of M05, M08, G94 & G95 codes?

Section (B)

Q. 2. Attempt any 5 questions.**(7 x 5 = 35)**

- a. What do you mean by graphic standards? Write a short note on any two graphic standards.
- b. An eight-plane raster display has a resolution of 1280*1024 and a refresh rate of 70 Hz non-interlaced. Find:
 - i. The RAM size of the bit map.
 - ii. The time required to display a scan line and a pixel.
 - iii. The active surface area of the screen if the resolution is 65 dpi.
- c. Generate a Bezier curve using the following control points: (2,0), (4,3), (5,2), (4,-2), (5,-3) and (6,-2).
- d. What is sweep representation in solid modelling? Explain different types of sweep to generate a solid model.
- e. What is rapid prototyping? Explain any one rapid prototyping technique with practical examples. What are its advantages and disadvantages?
- f. What is CNC and how it improves the overall performance of a manufacturing unit? How CNC is different from NC and DNC? Explain in detail.
- g. What is CIM and what are its benefits? How we can distinguish CIM from other manufacturing methodologies?

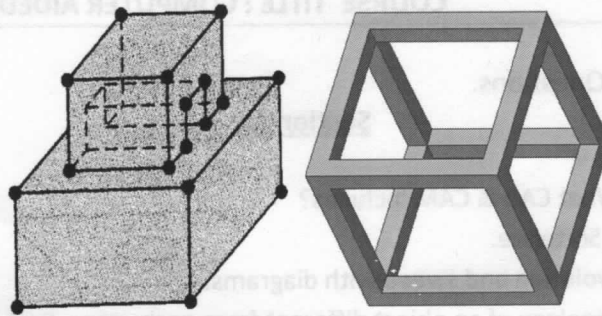
Section (C)

Attempt any 3 questions.

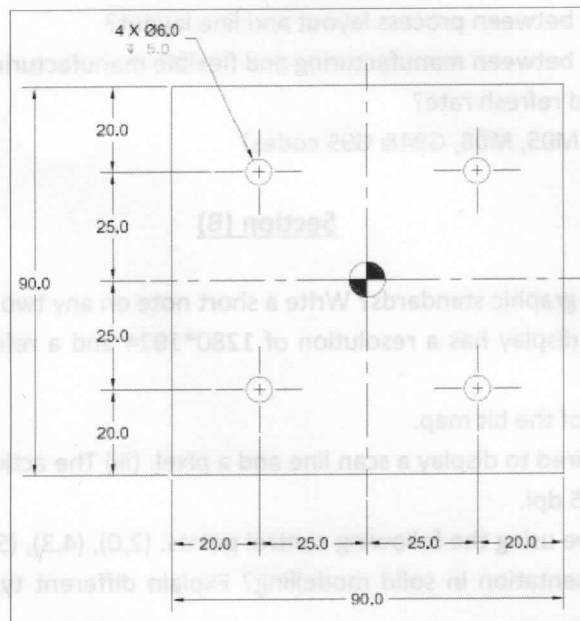
(15 x 3 = 45)

- Q.3.** Digitize the line with end points (20,10) and (30,18) using Bresenham's algorithm. Show the pixel positions graphically to draw this straight line.
- Q.4.** The coordinates of 4 control points are (1,1), (2,3), (4,3), & (3,1). Determine the equation of the Bezier curve and plot the curve for $t = 0, 0.25, 0.5, 0.75$ & 1.

Q.5. What is the necessary condition for a solid model? Solid models as shown below are valid solid or not?



Q.6. Write a program for the given drawing as shown below.



Q.7. What is Computer Integrated Manufacturing System? What are the nature and role of the major elements of the CIM system? Explain in detail.

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END SEMESTER EXAMINATION, JANUARY-2018
PROGRAM: B.TECH.(ME) SEVENTH SEMESTER

COURSE CODE : EME401**COURSE TITLE : TRIBOLOGY****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections & Questions.

Section (A)

Q. 1. Attempt all questions.**(2 x 10 = 20)**

- a. Briefly explain optimum design conditions for lubrication in bearing?
- b. Differentiate between iso viscous and viscous flow?
- c. State two methods for recycling of used oil?
- d. State the applications of lubrication in tribology?
- e. What types of conditions are developed when shaft rotates at zero speed?
- f. What are the types of contact bearing used in industry?
- g. Briefly explain the purpose of surface treatment?
- h. Give colour grading of oil?
- i. Define the techniques for surface examination?
- j. What are porous bearings?

Section (B)

Q. 2. Attempt any 5 questions.**(7 x 5 = 35)**

- a. Briefly describe any ten non ferrous metals for a good bearing?
- b. Explain Elasto hydrodynamic lubrication and discuss the relevance of compensators in fluid film lubrication flow?
- c. Explain the various surface coating techniques in detail? State the conditions for designing hydrostatic bearing
- d. Explain and design the annular thrust pad bearing?
- e. Explain hydrostatic thrust bearing and illustrate the conditions for optimum power loss?
- f. State any seven requirements for step bearing? Also explain lubrication for rectangular plate approaching a plane.
- g. Discuss and explain infinitely long and infinitely short journal bearing?

Section (C)

Attempt any 3 questions.

(15 x 3 = 45)

- Q. 3.**
 - a. What are the main components of lubricants, explain in detail? Also explain their chemical and physical properties?
 - b. Explain the Hertzian theory and state the Ertel-Grubin equation in detail? Also discuss the merits of using additives.
- Q. 4.**
 - a. Derive and explain Reynold's Equation?
 - b. What is extreme pressure lubrication? Explain the process of Hard facing.
- Q. 5.**
 - a. Explain the procedure of development of squeeze film lubrication in detail? Also explain the role of lubrication in rolling and drawing process.
 - b. Explain all the necessary tests for wear measurement? Give any two theories related to friction
- Q. 6.**
 - a. A hard ball sliding against a soft ball at two different loads with friction coefficient as 0.25 and groove width as 1 mm, similarly at some other conditions values are 0.25 and 0.6 mm then calculate radius of ball and friction coefficient.
 - b. The basic load capacity of ball bearing is 10 KN. Calculate its life on 90% reliability at 900 rpm and 15 KN load.
- Q. 7.**
 - a. Discuss oil conservation in detail? Describe the complete process for construction of bearings?
 - b. Explain the work of a tribologist related to industry and design? Also discuss oil seals and oil shields in detail.

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END SEMESTER EXAMINATIONS, JULY-2018
PROGRAM : B.TECH.(ME) SEVENTH SEMESTER

COURSE CODE : ECE513**COURSE TITLE : OPERATIONAL RESEARCH****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections & Questions. *Only non-programmable calculators are allowed.***SECTION A****Q. 1.** Attempt all parts of this question.**(2×10 = 20)**

- a. Any linear programming problem with multiple optimal solutions has at least _____ CPF solutions that are optimal.
- b. In Big M method, for the objective function to be maximized, the coefficient of the artificial variables in the objective function is _____.
- c. If all the elements of pivot column are less than or equal to zero, then the solution is:
 (i) Bounded (ii) unbounded (iii) optimal (iv) infeasible
- d. In game theory, the mixed strategy is a selection among pure strategies with _____ probabilities.
- e. If the principle of dominance is applicable to the payoff matrix having a saddle point, then the reduced matrix contains _____ elements.
- f. In a duality theory Dual of a Dual is again a _____.
- g. In the optimal solution of transportation problem, more than one empty cells have their opportunity cost as zero, it indicates that:
 (i) The solution is not optimal (ii) The problem has alternate solution
 (iii) Something wrong in the solution (iv) The problem will cycle
- h. The Assignment problem will have alternate solutions
 (i) When total opportunity cost matrix has at least one zero in each row and column
 (ii) When all rows have two zeros
 (iii) When there is a tie between zero opportunity cost cells
 (iv) If two diagonal elements are zeros
- i. In general, sequencing problem will be solved by using
 (i) Hungarian method (ii) Simplex method
 (iii) Johnson method (iv) Flood's technique
- j. Materials management is a body of knowledge, which helps manager to:
 (i) Study the properties of materials (ii) Search for needed material
 (iii) Increase the productivity of capital by reducing the cost of material (iv) None of the above

SECTION B**Q. 2.** Attempt any 5 questions of this section.**(7×5 = 35)**

- a. Using Vogel's Approximation Method, find the initial basic feasible solution of the following transportation problem and also find its optimal solution.

	I	II	III	IV	Supply
A	48	60	56	58	140
B	45	55	53	60	260
C	50	65	60	62	360
D	52	64	55	61	220
Demand	200	320	250	210	

- b. A car hire company has one car at each of five depots A, B, C, D and E. A customer requires a car in each town P, Q, R, S and T. Distances (in Km.) between depots and towns are given in the following table.

DEPOT → TOWN ↓	A	B	C	D	E
P	45	30	65	40	55
Q	50	30	25	60	30
R	25	20	15	20	40
S	35	25	30	30	20
T	80	60	60	70	50

How should cars be assigned to customers so as to minimize the distance traveled.

- c. A dealer of capital goods supplies you the following information with regard to a product dealt in by him: Annual demand = 5,000 units, ordering cost = Rs.25.00 per order, inventory carrying cost is 30% per unit per year of purchase cost Rs.100 per unit. The dealer is considering the possibility of allowing some back-orders to occur for the product. He has estimated that the annual cost of back-ordering the product will be Rs.10.00 per unit. Determine (a) Optimal lot size, (b) Optimum scheduling period, (c) Minimum total expected yearly cost. (d) Optimal number of order. When Backordering allowed and not allowed.
- d. Two politicians soon will be starting their campaigns against each other for a certain political office. Each must now select the main issue she will emphasize as the theme of her campaign. Each has advantageous issues from which to choose, but the relative effectiveness of each one would depend upon the issue chosen by the opponent. Apply the principle of dominance, find the optimal mixed strategies for both politicians. Also find the value of the campaign.

		Politician B				
		I	II	III	IV	V
Politician A	I	3	5	4	9	6
	II	5	6	3	7	8
	III	8	7	9	8	7
	IV	4	2	8	5	3

- e. The computer lab at Swami Rama Himalayan University has a help desk to assist students in registering for different courses offered by HSET. The students patiently form a single line in front of the desk to wait for help. Students are served based on a first-come, first-served priority rule. On average, 15 students per hour arrive at the help desk. Student arrivals are best described using a Poisson distribution. The help desk server can help an average of 20 students per hour, with the service rate being described by an Exponential distribution. Calculate the following operating characteristics of the service system:
- The average utilization of the help desk server
 - The average number of students in the system
 - The average number of students waiting in line
 - The average time a student spends in the system
 - The average time a student spends waiting in line
 - The probability that there are no students in the system
 - The probability of having more than 4 students in the system
- f. The Rocky Mountain Arsenal, formerly a chemical warfare manufacturing site, is said to be one of the most polluted locations in the United States. Cleanup of chemical waste storage basins will involve two operations. Operation 1: Drain and Dredge Basin. and Operation 2: Incinerate Materials.

Management estimates that each operation will require the following amounts of time (in days):

Operations	Storage Basin									
	A	B	C	D	E	F	G	H	I	J
Drain and Dredge	3	4	3	6	1	3	2	1	8	4
Incinerate	1	4	2	1	2	6	4	1	2	8

Management's objective is to minimize the makespan of the cleanup operations. All storage basins are available for processing right now. Find the sequence that minimizes the total elapsed time T. Also Calculate the total idle time of the two operations in this period.

- g. Mr. Sahani president of Aakriti Construction, is considering placing a bid on a building project. Mr. Sahani has determined that nine activities would need to be performed to carry out the project. Using the PERT three-estimate approach, Mr. Sahani has obtained the time estimates (in weeks) listed in the table below for how long these tasks will take. There is a penalty of Rs. 500,000 if the project is not completed in 30 weeks. Therefore, Bill is very interested in how likely it is that his company could finish the project in time.

Activity	Optimistic Time (t_o)	Most likely Time (t_m)	Pessimistic Time (t_p)
1-2	5	8	10
1-3	18	20	22
1-4	26	33	40
2-5	16	18	20
2-6	15	20	25
3-6	6	9	12
4-7	7	10	12
5-7	7	8	9
6-7	3	4	5

- Construct the project network for this project
- Find the Expected Duration & Variance of each activity
- Identify the Critical Path and Expected Project Completion time

SECTION C

Attempt **any 3** questions.

(15×3 = 45)
(10)

- Q. 3. a. Use Two-Phase Simplex method to solve the following LPP

$$\begin{aligned} \text{Maximize } Z &= 3x_1 + 2.5x_2 \\ \text{Subject to } 2x_1 + 4x_2 &\geq 40 \\ 3x_1 + 2x_3 &\geq 50 \\ \text{and } x_1 &\geq 0, x_2 \geq 0 \end{aligned}$$

- b. Solve the following game using saddle point to obtain the optimal strategy of for the two players A and B, also compute the value of game, given the pay-off matrix of the player A:

(5)

		Player B				
		I	II	III	IV	V
Player A	I	9	3	1	8	0
	II	6	5	4	6	7
	III	2	4	3	3	8
	IV	5	6	2	2	1

- Q. 4. a. Use Big-M method to solve the following LPP

(10)

$$\begin{aligned} \text{Minimize } Z &= 4x_1 + 8x_2 + 3x_3 \\ \text{Subject to } x_1 + x_2 &\geq 2 \\ 2x_1 + x_3 &\geq 5 \\ \text{and } x_1 &\geq 0, x_2 \geq 0, x_3 \geq 0 \end{aligned}$$

- b. Explain the processing of 2-jobs through m -machines. Define the graphical method to minimize the time added to process the jobs on machine.

(5)

- Q. 5. a. Solve the following game graphically to obtain the optimal strategy of for the two players A and B, also compute the value of game, given the pay-off matrix of the player A: (10)

		Player B		
		I	II	III
Player A	I	-2	0	2
	II	3	-1	3
	III	-3	2	3
	IV	5	-4	5

- b. Construct the dual of given LPP model (primal) (5)

$$\text{Maximize } Z = 5x_1 + 8x_2 + 7x_3$$

$$\text{Subject to } x_1 - 2x_2 + 4x_3 \geq 30$$

$$2x_1 + x_2 - 3x_3 \leq 20$$

$$3x_1 - 5x_2 + 4x_3 = 30$$

$$\text{and } x_1 \geq 0, x_2 \text{ unrestricted in sign, } x_3 \leq 0$$

- Q. 6. a. The Morris Machine Company just received an order to refurbish eight motors for materials handling equipment that were damaged in a fire. The motors have been delivered and are available for processing. The motors will be repaired at three workstations. The customer's shop will be inoperable until all the motors have been repaired, so the plant manager is interested in developing a schedule that minimizes the total elapsed time and has authorized around-the-clock operations until the motors have been repaired. Manager is also interested to calculate the total idle time for the each workstation in this period. The estimated time to repair each motor is shown in the following table: (10)

Products	I	II	III	IV	V	VI	VII	VIII
Workstation 1: Dismantle the Motor and Clean the Parts	2	5	2	3	1	2	4	2
Workstation 2: Replace the Parts as Necessary	4	1	3	5	5	6	2	1
Workstation 3: Test the Motor, and make Adjustments.	6	4	5	2	3	2	6	2

- b. What is an assignment problem? Describe Hungarian method to solve the problem. (5)

- Q. 7. a. A company manufacturing plant and equipment for chemical processing is in the process of quoting tender called by public sector undertaking. Manager has listed the following activity information for this project. Help the manager to participate in the tender on the basis of following estimation: (10)

Activity	A	B	C	D	E	F	G	H	I	J
Immediate Predecessor(s)	--	--	A	B	C,D	B	D,F	E	E,G	F,I
Estimated Duration(days)	10	15	5	12	14	8	15	10	6	9

- (i) Draw the network diagram of the project.
(ii) Develop the project schedule (EST, EFT, LST, LFT).
(iii) Find the critical path and maximum time for completion of the project.
(iv) Compute total floats and free floats for critical and non-critical activities.
- b. Define Queueing System and explain Kendall's notion (A/B/C): (D/E) for Queueing Model. (5)

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Enrol. No. S R H U

Regn. No. D D

END SEMESTER EXAMINATIONS, JUNE - 2018
PROGRAM : B.TECH. (ME) EIGHTH SEMESTER

COURSE CODE : EME424**COURSE TITLE : ALTERNATIVE SOURCES OF ENERGY****[Time allotted: Three hours]****[Max. Marks : 100]****Note:** Attempt all Sections & Questions. Assume suitable data if necessary.**SECTION A****Q. 1.** Attempt all questions.**(2 x 10 = 20)**

- a. What is extraterrestrial radiation?
- b. What is a heliostat?
- c. Explain solar altitude angle.
- d. What is top loss coefficient and side loss coefficient?
- e. What is the working principle of focusing collector?
- f. What do you understand by solar noon?
- g. What is the principle of MHD power plant?
- h. What is a solarimeter?
- i. Explain beam radiation and diffuse radiation.
- j. What is co-generation?

SECTION B**Q. 2.** Attempt any 5 questions.**(7 x 5 = 35)**

- a. Explain the working of solar furnace with neat and clean diagram.
- b. Explain the working of solar chimney power plant with neat and clean diagram.
- c. Explain the working of open cycle MHD power plant with neat and clean diagram.
- d. Explain at least seven of the various factors affecting the bio-gas generation.
- e. Explain the working of single basin and double basin tidal power plant with neat and clean diagram.
- f. Explain the working of liquid dominated Geo thermal power plant with neat and clean diagram.

SECTION C

Attempt any 3 questions.

(15 x 3 = 45)

- Q. 3.**
 - a. Derive the Betz equation for wind turbine. **(10)**
 - b. What are the various important factor of site selection for wind turbine, discuss at least five. **(5)**
- Q. 4.** A propeller type wind turbine operating at 1 standard atmospheric pressure 15°C atmospheric temperature and 15m/s wind speed has diameter 120m, and turbine operating speed=40 r.p.m at maximum efficiency take η for turbine=35%. Calculate:

i. the total power density in the wind stream	iv. The total power
ii. The maximum obtainable power density	v. The torque and axial thrust (3*5)
iii. A reasonably obtainable power density	
- Q. 5.** With neat and clean diagrams explain the working of: **(5*3)**
 - i. Open cycle OTEC system
 - ii. Closed cycle OTEC system
 - iii. Hybrid cycle OTEC system
- Q. 6.**
 - a. Derive the mathematical expression of overall loss coefficient for flat plate collector. **(10)**
 - b. Explain the working of photovoltaic system for electricity generation with diagram. **(5)**
- Q. 7.**
 - a. What will be the sunrise and sunset time in AM and PM for a location on the earth on 10 June, whose latitude angle is 30° . **(7.5)**
 - b. Explain the working of solar thermal power plant with neat and clean diagram. **(7.5)**

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END SEMESTER EXAMINATION, JUNE - 2018**PROGRAM : B.TECH. (ME / ECE / CE / CSE)****EIGHTH SEMESTER****COURSE CODE : EME517 / EEC521 / ECE515 / ECS511****COURSE TITLE : ENTREPRENEURSHIP DEVELOPMENT****[Time allotted: Three hours]****[Max. Marks: 100]****Note:** Attempt all Sections & Questions.**SECTION A****Q. 1.** Attempt **all** questions.**(2 x 10 = 20)**

- a. What is the difference between entrepreneur and manager?
- b. What is the role of DIC for entrepreneurs?
- c. What are the contributions of Deep Kalra as an entrepreneur?
- d. Entrepreneurship is the purposeful activity of an individual, who perform differently, explain in brief.
- e. Explain in brief "Passionate" in context of entrepreneur.
- f. How is the word "Market survey" related to entrepreneur?
- g. Explain in brief the "lack of proper planning" in context of EDP.
- h. EDP success is the responsibility of "Trainer/Expert/Motivator", explain in brief.
- i. Explain in brief "Historical factors" in context of entrepreneur.
- j. Define "Fear factor" in context of entrepreneurship.

SECTION B**Q. 2.** Attempt **any 5** questions.**(7 x 5 = 35)**

- a. Can we say HIMS, Jolly Grant is the example of entrepreneurship? Explain in detail.
- b. Name any seven women entrepreneurs with their contributions.
- c. Explain the importance of location for Industrial unit, and the factors responsible for it.
- d. What you mean by ownership? Explain any two forms of ownership.
- e. What you mean by capacity utilization? Which factors are responsible for lower capacity utilization?
- f. Explain any five methods to raise capital for own business.
- g. What you mean by sick unit, explain the main reasons for it and suggest remedial action to be taken?

SECTION CAttempt **any 3** questions.**(15 x 3 = 45)**

- Q. 3.**
 - a. What are the various schemes to assist entrepreneurs? Explain any two.
 - b. What you mean by DPR and what are the various steps to make it?
- Q. 4.**
 - a. What you mean by entrepreneur "Traits and behavior"? Explain any five.
 - b. What will be your practical approach to start your own small scale unit/business?
- Q. 5.**
 - a. Make a project report format for bank loan to be taken by entrepreneur and explain in brief.
 - b. What is a business model/business plan and what purpose it serves to entrepreneur?
- Q. 6.**
 - a. Explain cost effectiveness and maximizing profit and how to achieve it.
 - b. What are the merits and demerits of "franchising system"? Compare it with entrepreneurship.
- Q. 7.**
 - a. What you mean by feasibility analysis and why is it essential for entrepreneur?
 - b. What are the main objectives of EDP and what are the various steps for EDP?

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END SEMESTER EXAMINATIONS, JUNE - 2018
PROGRAM : B.TECH.(ME) EIGHTH SEMESTER

COURSE CODE : EME410**COURSE TITLE : PRODUCTION MANAGEMENT****[Time allotted: Three hours]****[Max. Marks : 100]****Note:** Attempt all Sections & Questions.

SECTION A

Q. 1. Attempt all questions.**(2 x 10 = 20)**

- a. What are the types of production system in an organization?
- b. How do we increase efficiency and effectiveness by using operation strategies?
- c. What are the basic steps in product design?
- d. Define cross functionality.
- e. Explain the basic principle behind material handling system.
- f. What are the differences between hybrid layouts and computerized layouts?
- g. Define any two advance manufacturing philosophy.
- h. State the purpose behind resource allocation and man power scheduling.
- i. What are the functions of routing and estimating?
- j. State any two methods for Job Scheduling.

SECTION B

Q. 2. Attempt any 5 questions.**(7 x 5 = 35)**

- a. Explain all the major factors influencing plant location.
- b. What are the major principles of plant layout? Also mention the advantages of plant layout.
- c. Discuss the relation between plant layout and material handling systems. State the various activities and functions related to material handling via flow chart.
- d. State the application of : (i) Fork lift truck (ii) Jib crane (iii) Conveyers
- e. Give detailed classification of forecasting methods.
- f. Explain each and every component of product life cycle in detail.
- g. Explain the development phase of production management in industry.

SECTION C

Attempt any 3 questions.

(15 x 3 = 45)

- Q. 3.** Discuss integrated manufacturing activities and their framework in detail. Which element of CAD system gives the physical demonstration of an object? Mention in detail with example. **(15)**
- Q. 4.** Explain the different types of production systems under operation management. **(15)**
- Q. 5.** Discuss the three basic sequencing & scheduling techniques in detail. **(15)**
- Q. 6.** Discuss lean manufacturing and its four pillars in detail. **(15)**
- Q. 7.** Discuss the production management framework in detail. **(15)**
