CBCS Scheme

USN | 2 | V | D | 1 | 5 | M | E | 0 | 7 | 9 | | 15ME/MA32

Third Semester B.E. Degree Examination, June/July 2018
Material Science

Time: 3 hrs. Max. Marks: 80

Note: Answer FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define atomic packing faction. Calculate the coordination No, atomic radius and APF for a HCP crystal structure. **(08 Marks)**

b. The surface of 1020 steel with 0.2% C to be carburized at 927°C. Calculate the time required to increase the carbon content to 0.4% at 1mm below the surface. if the carbon potential at the surface is 1.2% wt. Given $D = 1.28 \times 10^{-11}$ m^2/sec. **(08 Marks)**

Z	0.85	0.9	1.0
enf(z)	0.7707	0.797	0.842

OR

2 a. What is stress relaxation? Derive an expression for stress relaxation. **(08 Marks)**

b. Define Fatigue. Explain the different types of stress cycles that cause fatigue failure, with sketches. **(08 Marks)**

Module-2

3 a. What is solid solution? Mention the types of solid solution. Explain the factors given by Hume Rolhery that govern the formation of solid solution. **(08 Marks)**

b. Explain the effect of any 8 alloying elements on the properties of steel. **(08 Marks)**

OR

4 a. Draw the Iron Carbon diagram and label all the points and fields in it. Explain the different phases in it. **(08 Marks)**

b. Two metals A and B with melting temperatures 850°C and 1100°C respectively having unlimited liquid solubilities. They form an eutectic solid solution at 600°C and a composition of 35% A and 65%B. The maximum solid solubility of A in B is 10% at Eutectic temperature and 5% at room temperature. The maximum solubility of B in A is 16% at eutectic temperature and 7% at room temperature. Assume liquidus, solidus and solvers lines to be straight.

i) Draw the phase diagram and label all the regions.

ii) Determine the NO, relative amount of phases at room temperature for an alloy of 60% A and 40% B. **(08 Marks)**

Module-3

5 a. Draw a TTT diagram for plain carbon steel and label the fields. Show the cooling curve which form 100% marten site on it and explain it. **(08 Marks)**

b. Give the detailed classification of heat treatment types. Explain Mastempering and Austempering, with sketches. **(08 Marks)**

OR

6 a. What is age hardening? Explain age hardening of at 0.4% Cu alloy showing the microstructure, with sketch. **(08 Marks)**

b. Explain the composition, structure and properties of 4 types of Cast Iron. **(08 Marks)**

Module-4

7 a. State and explain the mechanical and electrical properties of ceramic materials. **(08 Marks)**

b. How are plastics classified based on structure and behaviour? Give the advantages and disadvantages of plastic materials. **(08 Marks)**

OR

8 a. What are smart materials? Write short notes on Piezo electric materials and shape memory alloys. **(08 Marks)**

b. What is residual life assessment and its importance? Explain any 3 non destructive testing methods used for accessing residual life. **(08 Marks)**

Module-5

9 a. Define composite material. Explain the role of matrix interface and reinforcement in a composite material. **(08 Marks)**

b. Explain Resin transfer moulding process, with a neat sketch. State its advantages and disadvantages. **(08 Marks)**

OR

10 a. Under Iso-Strain condition derive an expression for Youngs modulus of fiber reinforced composites. List the advantages and applications of composite materials. **(08 Marks)**

b. With a neat sketch explain injection moulding process and state its advantages. **(08 Marks)**

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CBCS Scheme

USN | | | | | | | | | | |

15ME33

Third Semester B.E. Degree Examination, June/Jul 2018
Basic Thermodynamics

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing one full question from each module.
2. Thermodynamics data hand book and steam tables are permitted.
3. Missing data may be assumed suitably.

Module-1

1 a. What is the difference between intensive and extensive property? Give examples. **(04 Marks)**

b. What is Quasi static process? Explain its importance in engineering. **(04 Marks)**

c. On some temperature scale 0°C is equivalent to 100°B and 100°C is equivalent to 300°B. Determine the temperature in °C corresponding to 200°B. Convert the temperature obtained in °C to Fahrenheit and Kelvin scale. **(08 Marks)**

OR

2 a. Define work and heat in thermodynamics. Explain why neither is a property. **(06 Marks)**

b. Derive an equation for work in Isobaric and Isochoric processes. **(04 Marks)**

c. A piston compresses a gas in a cylinder during quasi equilibrium process. The pressure in the cylinder varies according to the relationship $PV^{1.4}$ = constant. Initial pressure in the cylinder is 101,325 N/m^2 and the initial volume of the cylinder is $0.01 m^3$. Compute the work in compressing the gas to a final volume of $0.005 m^3$. **(06 Marks)**

Module-2

3 a. Write the first law of thermodynamics equation for closed system undergoing a non cyclic process and show that internal energy is property. **(06 Marks)**

b. Write the steady flow energy equation for a single entry stream and single exit stream. Indicate the SI unit for each term. **(04 Marks)**

c. Steam expands through a turbine in a steady flow adiabatic process. The mass flow rate of the steam is 1.36 kg/s. The entering state of steam is 34.48 bar and 538°C, while the existing state is 6.896 bar and 294°C. Neglecting the changes in kinetic and potential energies, find the power output for the turbine. Assume C_p for steam as 2.01 kJ/kg K. **(06 Marks)**

OR

4 a. What is a Thermal Reservoir, give example? **(02 Marks)**

b. Show that the efficiency of a reversible heat engine is higher than a irreversible heat engine when both are working between same temperature limits. **(06 Marks)**

c. A heat engine receives half of its heat at a temperature of 1000K and the rest at 500K while rejecting heat to a sink at 300K. What is the maximum possible efficiency of this heat engine? **(08 Marks)**

Module-3

5 a. What is a reversed heat engine? **(02 Marks)**

b. Mention the factors which render a process irreversible. **(06 Marks)**

c. The efficiency of the Carnot engine rejecting heat to a sink at 7°C is 32%. If the heat rejected to the sink is 16.66 kJ/s. What is the power developed by the engine? Also determine the source temperature. **(08 Marks)**

OR

6 a. Derive the two Tds expressions for change in entropy of an Ideal gas. **(08 Marks)**

b. Water is heated from 25°C to 90°C as it flows at a rate of 0.5kg/s through a tube that is immersed in a hot bath at 100°C. Calculate heat transfer, entropy change for water, oil bath and universe. **(08 Marks)**

Module-4

7 a. What is available energy, un available energy? **(03 Marks)**

b. Show that the Joule Thomson coefficient for a gas can be expressed as

$$\mu_h = \frac{1}{C_p}\left[T\left(\frac{\partial V}{\partial T}\right)_p - v\right]. \quad \textbf{(08 Marks)}$$

c. Obtain an expression for availability of a non-flow process. **(05 Marks)**

OR

8 a. With the help of P-T diagram define i) Triple point ii) Critical point. **(06 Marks)**

b. Use steam table to determine the unknown properties in the following:

i) P = 1 bar v = 2.41 m^3/kg T = _____

ii) P = 1 MPa, T = 150°C, v = _____

iii) T = 100°C, h_g = 2676 kJ/kg P_s = _____

iv) P = 10 bar, T = 250°C, h = _____. **(04 Marks)**

c. Steam is throttled from a pressure of 15 bar to 1.5 bar. If the steam is dry saturated at the end of expansion, what is the dryness fraction at the beginning. Also calculate the change in entropy during throttling. **(06 Marks)**

Module-5

9 a. Derive the expressions for specific heat at constant pressure and constant volume for mixture of gases. **(08 Marks)**

b. A mixture of gases comprises 30% CO, 15% CO_2 and 55% H_2. Find the gravimetric analysis specific gas constant and molecular weight of the mixture. **(08 Marks)**

OR

10 a. Explain the following:

i) Reduced properties

ii) Law of corresponding state

iii) Gibbs-Daltons law

iv) Compressibility factor. **(08 Marks)**

b. 10 kg of Carbon dioxide is enclosed in a container at a temperature of 100°C and pressure of 1 bar. Compute the volume of the container by

i) Ideal gas equation

ii) Vander Walls equation

iii) Compressibility chart. **(08 Marks)**

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CBCS SCHEME

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15ME/MA34

Third Semester B.E. Degree Examination, June/July 2018
Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define: i) True stress ii) Poissons ratio iii) Resilience iv) Rigidity Modulus. **(04 Marks)**

b. Derive an expression for the extension of a tapering bar whose diameter d_1 at one end tapers linearly to a diameter d_2 in a length L, under an axial pull 'P' and Young's modulus E. **(06 Marks)**

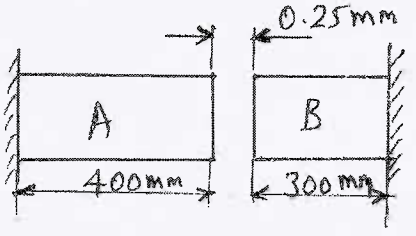
c. The tensile test was conducted on a mild steel bar. The following data was obtained from the test. Diameter of steel bar = 16mm, load at proportional limit = 72kN, load at failure = 80kN, diameter of the rod at failure = 12mm, gauge length = 80MM, extension at a load of 60kN = 0.115mm, final length = 104mm. Determine: i) Young's modulus ii) Proportionality limit stress iii) True breaking stress iv) Percentage Elongation in length v) Percentage reduction in area. **(06 Marks)**

OR

2 a. Derive relationship between Young's modulus (E), rigidity modulus (G) and bulk modulus (K). **(08 Marks)**

b. At room temperature the gap between bar A and bar B shown in Fig.Q.2(b) is 0.25mm. What are the stresses induced in the bars, if temperature rise is 35°C? Given.
$A_A = 1000mm^2$, $A_B = 800mm^2$,
$E_A = 2 \times 10^5$ N/mm^2, $E_B = 1 \times 10^5$ N/mm^2,
$\alpha_A = 12 \times 10^{-6}$/°C, $\alpha_B = 23 \times 10^{-6}$/°C,
$L_A = 400mm$, $L_B = 300mm$. **(08 Marks)**

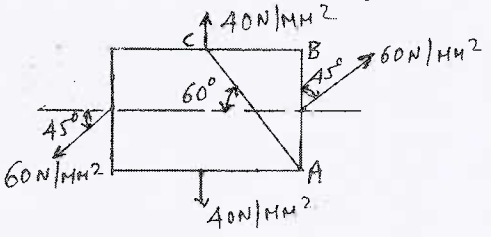
Fig.Q.2(b)



Module-2

3 a. An element is subjected to stresses as shown in Fig.Q.3(a). Determine: i) Principal stresses and their directions ii) Normal and tangential stress on plane AC. **(10 Marks)**

Fig.Q.3(a)



b. Prove that the change in volume in thin cylinder is equal to $\frac{Pd}{4tE}(5-4\mu)V$. **(06 Marks)**

OR

4 a. A pipe of 400mm internal diameter and 100mm thickness contains a internal fluid pressure 80N/mm^2. Calculate and sketch radial and hoop stress distribution across the section. **(10 Marks)**

b. Derive an expression for hoop stress and longitudinal stress for thin cylinder. **(06 Marks)**

Module-3

5 a. Classify beams and loads with sketch. **(04 Marks)**

b. Draw the shear force and bending moment diagrams for the beam shown in Fig.Q.5(b). Locate the salient point. **(12 Marks)**

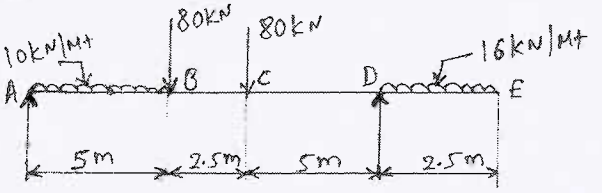


Fig.Q.5(b)

OR

6 a. A cast iron beam has an 'I' section with top flange 80mm × 40mm, web 120mm × 20mm and bottom flange 160mm × 40mm. If the tensile stress is not to exceed 30N/mm^2 and compressive stress 90N/mm^2, what is the maximum uniformly distributed load the beam carry over a simply supported span of 6m, if the large flange is in tension. **(10 Marks)**

b. Derive an expression for the maximum deflection of a cantilever beam carrying a point load at its free end. **(06 Marks)**

Module-4

7 a. State the assumption made in pure torsion and with usual notations derive torsion equation. **(08 Marks)**

b. A solid shaft is required to transmit 245 kW power at 240rpm. The maximum torque may be 1.5 times the mean torque. The shear stress in the shaft should not exceed 40N/mm^2 and the twist is 1°/meter length. Determine the diameter required, if the shaft is solid. G = 80kN/mm^2. **(08 Marks)**

OR

8 a. Derive the expression for Euler's crippling load for a column when both ends are hinged or pinned. **(08 Marks)**

b. Determine the crippling load for a 'T' section of dimensions 100mm × 100mm × 20mm and length of column 12m with both ends fixed. Take E = 210 GPa. **(08 Marks)**

Module-5

9 a. Define: i) Strain energy ii) Castigliano's theorem iii) Modulus of resilience iv) Toughness. **(08 Marks)**

b. A cantilever beam of uniform cross section carries a point load at the free end. Determine strain energy and deflection at the free end. If F = 200kN, E = 200GPa, L = 3mt and I = 10^{-4}m^4. **(08 Marks)**

OR

10 a. Explain maximum normal stress theory and maximum shear stress theory. **(08 Marks)**

b. A plate of 45C8 steel (σ_{yt} = 353MPa) is subjected to the following stresses. σ_x = 150 N/mm^2, σ_y = 100N/mm^2 and τ_{xy} = 50N/mm^2. Find the factor of safety by i) Rankine's theory ii) Guest's theory. **(08 Marks)**

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10ME34/10AU34

Third Semester B.E. Degree Examination, June/July 2018
Mechanics of Materials

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Draw stress-strain diagram, for a mild steel subjected to tension and indicate salient points on the diagram. **(06 Marks)**

b. Define : (i) Nominal stress (ii) True stress (iii) Hook's law. **(04 Marks)**

c. A member is subjected to point loads as shown in Fig. Q1 (c). Calculate P_2 necessary for equilibrium. Take $E = 2.05 \times 10^5$ N/mm^2. **(10 Marks)**

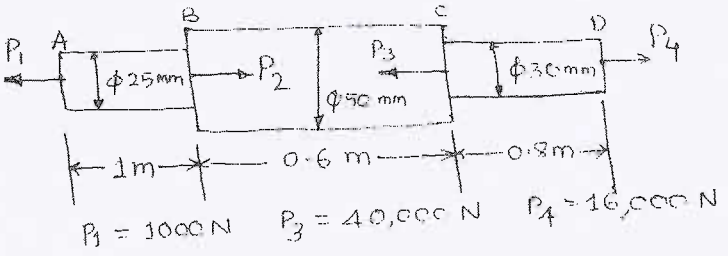

Fig. Q1 (c)

2 a. Define : (i) Poisson's ratio (ii) Modulus of rigidity (iii) Bulk modulus and (iv) Volumetric strain. **(04 Marks)**

b. Establish the relationship between modulus of elasticity and Bulk modulus in case of a cube subjected to three mutually perpendicular like compressive stresses of equal intensity 'P'. **(06 Marks)**

c. A composite bar is rigidly fitted at the supports A and B as shown in Fig. Q2 (c). Determine the reactions at supports when temperature rises by 20°C. Take E_a = 70 GN/m^2, $E_S = 200$ GN/m^2, $\alpha_a = 11 \times 10^{-6}$/°C, $\alpha_S = 12 \times 10^{-6}$/°C **(10 Marks)**

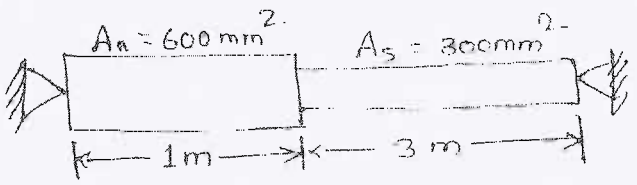

Fig. Q2 (c)

3 a. The state of stress at a point in a strained material is as shown in Fig. Q3 (a). Determine :
(i) The magnitude of principal stresses.
(ii) The direction of principal stresses and
(iii) The magnitude of the maximum shear stress and its direction.
Indicate all the planes by a sketch. **(10 Marks)**

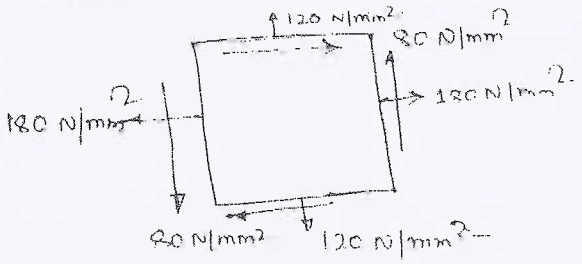

Fig. Q3 (a)

b. The direct stresses at a point in a strained material are 100 N/mm^2 and 60 N/mm^2 as shown in Fig. Q3 (b). Determine stress on the inclined plane AC. **(10 Marks)**

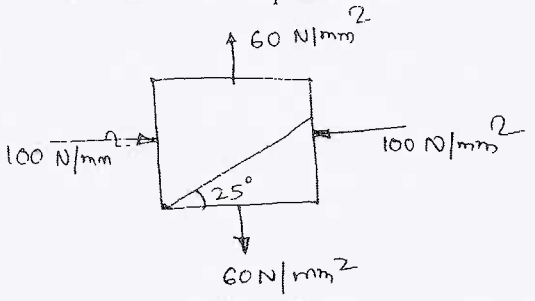

Fig. Q3 (b)

4 a. Define strain energy and Resilience. **(02 Marks)**

b. Two bars, each of length L and of different materials are each subjected to the same tensile force P. The first bar has a uniform diameter 'D' and the second bar has a diameter of $\frac{D}{2}$ for a length $\frac{L}{4}$ and a diameter D for the remaining length. Compare the strain energies of the two bars if, (i) $\frac{E_1}{E_2} = \frac{4}{7}$ and (ii) $E_1 = E_2$ **(08 Marks)**

c. A thin cylindrical shell 2 m long has 200 mm diameter and thickness of metal 10 mm. It is filled completely with a fluid at atmospheric pressure. If an additional fluid of 25000 mm^3 is pumped in, find the pressure developed. Find also the changes in diameter and length. Take $E = 2\times10^5$ N/mm^2 and $\mu = 0.3$. **(10 Marks)**

PART – B

5 a. With neat sketches explain: (i) Types of beams. (ii) Types of loads (iii) Types of supports. **(06 Marks)**

b. The simply supported beam shown in Fig. Q5 (b), carries two concentrated loads and a uniformly distributed load. Draw shear force diagram and bending moment diagram. **(14 Marks)**

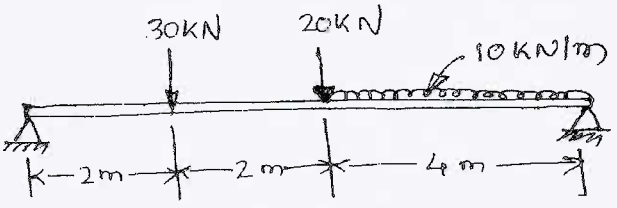

Fig. Q5 (b)

6 a. State the assumptions made in simple theory of bending. **(04 Marks)**

b. A circular pipe of external diameter 70 mm and thickness 8 mm is used as a simply supported beam over an effective span of 2.5 m. Find the maximum concentrated load that can be applied at the centre of the span if permissible stress in tube is 150 N/mm^2. **(08 Marks)**

c. A wooden section 300mm × 300mm has a central bore of 100 mm diameter as shown in Fig. Q6 (c). If it is used as a beam to resist a shear force of 10 kN, find the shearing stress at crown of the bore and at neutral axis. **(08 Marks)**

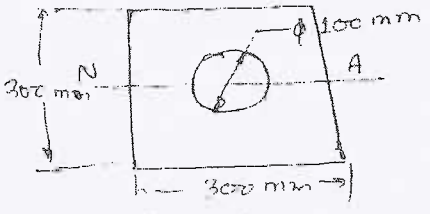

Fig. Q6 (c)

7 a. Find displacement at free end of the Cantilever beam shown in Fig. Q7 (a). Take $E = 2\times10^5$ N/mm^2 and $I = 2\times10^8$ mm^4. **(08 Marks)**

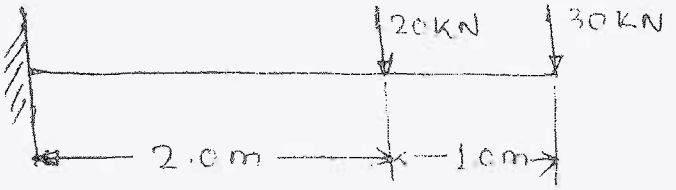

Fig. Q7 (a)

b. A simply supported beam of 6 m span is subjected to a set of loads as shown in Fig. Q7 (b). Find maximum deflection and the maximum slope for the beam. Take $EI = 15\times10^9$ KN-mm^2. Use Macanlay's method. **(12 Marks)**

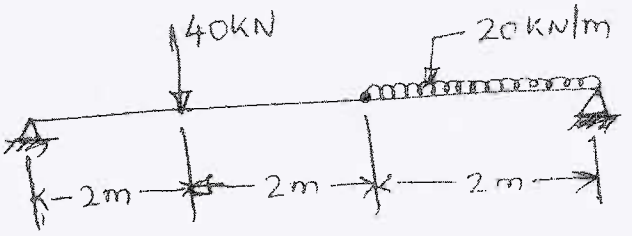

Fig. Q7 (b)

8 a. Determine the diameter of solid shaft which transmits 440 kW at 280 rpm. The angle of twist must not exceed one degree per meter length and the maximum shear stress is to be limited to 40 N/mm^2. Assume G = 84 KN/mm^2. **(10 Marks)**

b. A 2 m long pin ended column of square cross section is to be made of wood. Assuming E = 12 GPa and allowable stress being limited to 12 MPa. Determine the size of the column to support the following loads (i) 95 kN (ii) 200 kN. **(10 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | |

15MEA305/15ME35A

Third Semester B.E. Degree Examination, June/July 2018
Metal Casting and Welding

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Explain basic steps involved in a sand casting process. **(08 Marks)**

b. What is pattern? List the types and explain the following with neat sketches:
(i) Two piece pattern (ii) Match plate pattern **(08 Marks)**

OR

2 a. With neat sketch explain Jolt squeeze type molding machine showing pattern and molding box. **(08 Marks)**

b. Explain the different steps involved in shell molding process with neat sketches. **(08 Marks)**

Module-2

3 a. What is die-casting? With neat and labelled sketch explain cold chamber die casting process. **(08 Marks)**

b. With neat sketch explain continuous casting process and mention advantages and disadvantages. **(08 Marks)**

OR

4 a. With neat sketch explain the working of a direct arc electric furnace. **(08 Marks)**

b. Draw and explain the basic principle of a resistance furnace. **(08 Marks)**

Module-3

5 a. What is nucleation? Explain Homogeneous nucleation and Heterogeneous nucleation with sketches. **(08 Marks)**

b. Explain different sand casting defects, its causes and remedies. **(08 Marks)**

OR

6 a. What is the need for directional solidification and explain any four methods of achieving directional solidification. **(08 Marks)**

b. Explain differential solidification variables with sketch. **(08 Marks)**

Module-4

7 a. Sketch and explain Metal Inert Gas welding & its advantages and disadvantages. **(08 Marks)**

b. What is the principle of resistance welding? Explain projection welding with sketch. **(08 Marks)**

OR

8 a. With neat sketch explain electron beam welding and write advantages, disadvantages and applications. **(08 Marks)**

b. Define welding process. Classify it and write advantages, disadvantages and applications of it. **(08 Marks)**

Module-5

9 a. Compare the soldering and brazing process mention their advantages, disadvantages and applications. **(08 Marks)**

b. Explain fluorescent penetrant method of inspection with neat sketch. **(08 Marks)**

OR

10 a. With neat sketch, explain heat affected zone (HAZ) and its various zones. **(08 Marks)**

b. Explain briefly welding defects and its causes. **(08 Marks)**

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10MEA/AUA302

Third Semester B.E. Degree Examination, June/July 2018
Material Science & Metallurgy

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Illustrate the following point defects which disrupt the perfect arrangement of the surrounding atoms in a crystal structure. **(15 Marks)**
(i) Vacancy (ii) Interstitial atom (iii) Small substitutional atom
(iv) Large substitutional atom. (v) Frenkel defect.

b. What is atomic diffusion? Mention any 3 examples of diffusion. **(05 Marks)**

2 a. Discuss how the stress-strain behavior of iron varies with temperature. **(12 Marks)**

b. An aluminum specimen originally 300 mm long is pulled in tension with a stress of 280 MPa. If the deformation is entirely elastic, what will be the resultant elongation? E for Aluminum is 69 GPa. **(03 Marks)**

c. A tensile stress is applied along the longitudinal direction of a cylindrical aluminum rod that has a diameter of 10 mm. Determine the magnitude of the load required to produce a 2.5×10^{-3} mm change in diameter, if the deformation is entirely elastic. E for aluminum is 69 GPa, Poisson's ratio for Al is 0.33. **(05 Marks)**

3 a. Present a schematic representation of the typical constant load creep behavior of metals and discuss. **(08 Marks)**

b. What is fatigue limit? Also, discuss the stress amplitude (s) versus logarithm of the number of cycles (N) to fatigue failure of metals for, (i) a material that displays a fatigue limit and (ii) a material that does not display a fatigue limit. **(12 Marks)**

4 a. Explain with necessary diagrams, how the macrostructure (ingot structure) of a casting develops during solidification. **(12 Marks)**

b. State the Gibbs phase rule. **(02 Marks)**

c. Explain the Hume-Rothery rules for extensive solid solubility of one element in another. **(06 Marks)**

PART – B

5 a. Illustrate the microstructures for an iron-carbon alloy of eutectoid composition, above and below the eutectoid temperature. **(12 Marks)**

b. Determine the composition of each phase in a Cu-40% Ni alloy at 1300°C, 1270°C, 1250°C and 1200°C (Use Fig. Q5 (b)). **(08 Marks)**

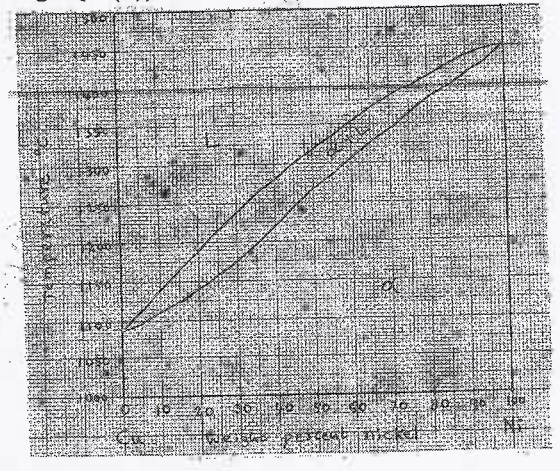

Fig. Q5 (b)

6 a. Illustrate the formation of quench cracks in steels, when they are quenched. Also, discuss the marquenching heat treatment designed to reduce residual stresses and quench cracking. **(10 Marks)**

b. Illustrate the setup for the Jominy test used for determining the hardenability of steel. Also show hardenability curves for several steels. **(10 Marks)**

7 a. Show schematically the microstructures of the following types of cast iron : Gray iron, White iron, Malleable iron, ductile iron and compacted graphite iron. **(10 Marks)**

b. List the properties and applications of copper and aluminum alloys. **(10 Marks)**

8 a. What are composite materials? How they are classified? **(07 Marks)**

b. Illustrate the following production methods:

(i) Hand lay-up method for molding fiber reinforced plastic.

(ii) Filament winding process for producing fiber-reinforced plastic composite material. **(10 Marks)**

c. Schematically represent the following types of fiber reinforced composites:

(i) Continuous and aligned fibers.

(ii) Discontinuous and aligned fibers.

(iii) Discontinuous and randomly oriented fibers. **(03 Marks)**

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CBCS SCHEME

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15ME36B/15MEB306

Third Semester B.E. Degree Examination, June/July 2018
Mechanical Measurements and Metrology

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions, choosing one full question from each module.*

Module-1

1 a. What is Metrology? State the objectives of metrology. **(05 Marks)**
b. Compare Line and End standards. **(05 Marks)**
c. Explain with a sketch, International prototype meter. **(06 Marks)**

OR

2 a. With neat sketch, explain wringing phenomena of slip gauge. **(05 Marks)**
b. Explain principle of sine bar. **(05 Marks)**
c. Build a slip gauge combination using M – 112 set for the given dimensions.
i) 49.3115mm ii) 68.208mm. **(06 Marks)**

Module-2

3 a. Define Limits, Fits and Tolerance. **(06 Marks)**
b. Explain with neat sketch, different types of fits. Give examples each. **(10 Marks)**

OR

4 a. Explain Johnson Microkater comparator, with neat sketch. **(08 Marks)**
b. With neat sketch, explain LVDT and state its advantages. **(08 Marks)**

Module-3

5 a. Explain with neat sketch, the method of measuring minor diameter of external thread and internal thread. **(08 Marks)**
b. Explain with neat sketch, measuring of gear tooth thickness using gear tooth vernier. **(08 Marks)**

OR

6 a. Explain Tool maker's microscope, with neat sketch. **(08 Marks)**
b. Explain Construction and working principle of CMM, with neat sketch. **(08 Marks)**

Module-4

7 a. Give complete classification of errors. **(04 Marks)**
b. Define Accuracy, Precision, Sensitivity and Repeatability. **(08 Marks)**
c. Explain Piezoelectric effect. **(04 Marks)**

OR

8 a. Explain Ballast Circuit. **(08 Marks)**
b. With neat sketch, explain Cathode ray Oscilloscope. **(08 Marks)**

Module-5

9 a. Explain Platform balance, with neat sketch. **(08 Marks)**
b. Describe with neat sketch, McLeod vaccum gauge. **(08 Marks)**

OR

10 a. State the laws of Thermocouples. **(05 Marks)**
b. Define Gauge factor. Explain foil type bonded resistance strain gauge. **(07 Marks)**
c. Mention Strain gauge materials and bonding materials. **(04 Marks)**

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CBCS Scheme

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15ME42

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Kinematics of Machines

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Explain:
i) kinematic pair,
ii) Types of links,
iii) Grashof's criterion. **(06 Marks)**

b. Explain with neat sketches:
i) Ratchet and pawl mechanism
ii) Toggle mechanism. **(10 Marks)**

OR

2 a. What is quick return motion? Explain with neat sketch crank and slotted lever mechanism. **(08 Marks)**

b. Draw a neat sketch of Peacellier straight line mechanism. Explain with proof how the tracing point describes a straight line path. **(08 Marks)**

Module-2

3 A four bar mechanism ABCD is pin jointed at ends and the link AD is fired of length 600 mm. The links AB, BC and CD are 300 mm, 360 mm and 360 mm respectively. At certain instant the link AB makes an angle of 60° with link AD. If the link AB rotates at an angular velocity of 10 rad/s and an angular acceleration of 30 r/s^2 both clockwise. Determine angular velocity and angular accelerator of links BC and CD by graphical method. **(16 Marks)**

OR

4 a. Define Coriol's component of acceleration. Derive an expression for the same. **(08 Marks)**

b. Determine the velocity and acceleration of the piston by Klein's construction for a steam engine to the following specifications:
Stroke of piston = 300 mm
Ratio of length of connecting rod to crank radius = 4
Speed of engine = 300 rpm
Clockwise position of crank = 45° with inner dead centre. **(08 Marks)**

Module-3

5 a. Derive analytical expressions for the determination of velocity and acceleration of piston of a reciprocating engine. **(12 Marks)**

b. If the crank and connecting rod are 150 mm and 600 mm long respectively and the crank rotates at a constant speed of 100 rpm, determine the velocity and acceleration of piston. The angle which the crank makes with the inner dead centre is 30°. **(04 Marks)**

OR

6 a. Derive Freudenstein's equation for slider crank mechanism. **(10 Marks)**

b. Explain function generation for four bar mechanism. **(06 Marks)**

Module-4

7 a. State and prove the law of gear tooth action for constant velocity ratio. **(08 Marks)**

b. Two mating spur gears with module of 6.5 mm have 19 and 47 teeth of 20° pressure angle, and 6.5 mm addendum. Determine the number of pairs of teeth in contact. Also determine the sliding velocity at the instant (i) engagement commences, (ii) engagement terminates. The pitch line velocity is 1.2 m/s. **(08 Marks)**

OR

8 a. Define: (i) Interference in gears. (ii) Epicyclic gear train. **(04 Marks)**

b. Fig.Q8(b) shows an epicyclic gear train. Pinion A has 15 teeth and is rigidly fixed to the motor shaft. The wheel B has 20 teeth and gears with A and also with the annular fixed wheel D. Pinion C has 15 teeth and is integral with B (B, C being a compound gear wheel), gear C meshes with annular wheel E, which is keyed to the machine shaft. The arm rotates about the same shaft on which A is fixed, and carries the compound wheel B, C. If the motor runs at 1000 rpm, find the speed of the machine shaft. Find the torque exerted on the machine shaft if the motor develops a torque of 100 Nm.

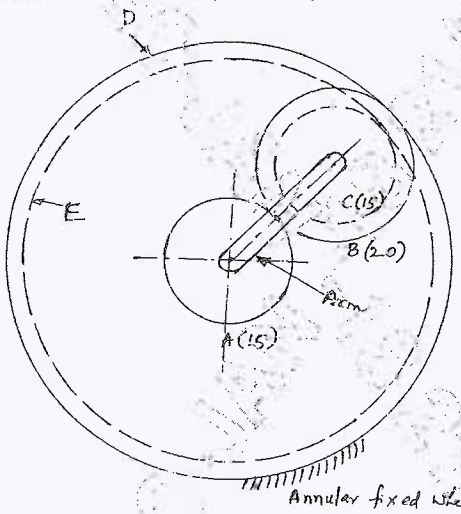

Fig.Q8(b) **(12 Marks)**

Module-5

9 A cam rotating clockwise at uniform speed of 300 rpm operates a reciprocating follower through a roller 1.5 cm diameter. The follower motion is defined as below:

i) Outward during 150° with UARM.
ii) Dwell for next 30°.
iii) Return during next 120° with SHM.
iv) Dwell for the remaining period.

Stroke of the follower is 3 cm. Minimum radius of the cam is 3 cm. Draw the cam profile, when the follower axis passes through the cam axis. Find the maximum velocity and acceleration during outstroke. **(16 Marks)**

OR

10 a. Define the terms:
i) Cam profile
ii) Base circle
iii) Prime circle
iv) Pitch curve **(04 Marks)**

b. Derive expressions for displacement, velocity and acceleration of the follower when the flat faced follower is in contact with any point on the circular flank. **(12 Marks)**

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CBCS Scheme

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15ME43

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Applied Thermodynamics

Time: 3 hrs. Max. Marks: 80

Note: 1. *Answer FIVE full questions, choosing one full question from each module.*
2. *Use thermodynamic data hand book and steam tables is permitted.*

Module-1

1 a. Compare the otto, diesel and dual cycles on P-V diagram and T-S diagrams, when heat is supplied to each cycle is same. **(08 Marks)**

b. Derive air standard efficiency expression for dual combustion cycle. **(08 Marks)**

OR

2 a. With a schematic diagram, explain a closed cycle gas turbine. **(04 Marks)**

b. With the help of neat diagram, explain a Rocket engine. **(04 Marks)**

c. The air enters the compressor of an open cycle constant pressure gas turbine at a pressure of 1 bar and temperature 20°C. The pressure of the air after the compression is 4 bar. The isentropic efficiencies of the compressor and turbine are 80% and 85% respectively. The air fuel ratio is 90 : 1. If flow rate of air is 3 kg/sec. Find (i) Power developed (ii) Thermal efficiency of the cycle.
Assume C_P = 1.0 kJ/kgK and γ = 1.4 for air and gases. Take calorific value of the fuel as 41800 KJ/kg. **(08 Marks)**

Module-2

3 a. List out the factors affecting the efficiency of the Rankine cycle. **(04 Marks)**

b. Compare the Rankine and the Carnot cycles of steam power plants. **(04 Marks)**

c. In a steam power cycle, the steam supply is at 15 bar and dry saturated. The condenser pressure is 0.4 bar. Calculate Carnot and Rankine efficiency of the cycle neglect the pump work. **(08 Marks)**

OR

4 a. What do you mean by Regenerative cycle? With help of neat diagram, explain the working of a regenerative Rankine cycle and derive the efficiency of the cycle. **(08 Marks)**

b. Consider a regenerative vapour power cycle with open feed water heater. Steam enters the turbine at 9 MPa and 350°C and expands to 0.9 MPa where some of the steam is extracted and passed to the open feed water heater operating at 0.9 MPa. The remaining steam expands through the remaining part of the turbine to the condenser pressure of 0.01 MPa. Saturated liquid exits the open feed water heater at 0.9 MPa. If the net power output of the cycle is 120 MW. Determine
(i) Thermal efficiency (ii) Mass flow rate of steam entering the turbine. **(08 Marks)**

Module-3

5 a. Explain the following terms with reference to a combustion process:
(i) Enthalpy of formation (ii) Adiabatic flame temperature
(iii) Enthalpy of combustion (iv) Heat of reaction **(08 Marks)**

b. Methane is burned with atmospheric air. The analysis of the products on a dry basis is as follows:
CO_2 = 10%, O_2 = 2.37%, CO = 0.53%, N_2 = 87.10%
(i) Determine the combustion equation.
(ii) Calculate the air fuel ratio on mass basis.
(iii) Percent theoretical air. **(08 Marks)**

OR

6 a. Explain the combustion phenomenon in C.I. engine. **(08 Marks)**

b. A single cylinder 4 stroke diesel engine gave the following results while running on full load. Area of indicator card = 300 mm^2, Spring constant = 1 bar/mm,
Length of the diagram = 40 mm, Speed of the engine = 450 rpm, Load on the brake = 370 N, Spring balance reading = 50 N, Diameter of the brake drum = 1.2 m,
Diameter of the cylinder = 160 mm, Stroke of the piston = 200 m,
C.V of the fuel = 41800 KJ/kg.
Calculate (i) IMEP
(ii) BP and brake mean effective pressure
(iii) BSFC (Brake Specific Fuel Consumption)
(iv) Brake thermal and indicated thermal efficiency. **(08 Marks)**

Module-4

7 a. With the help of a neat sketch, explain a simple vapour absorption cycle. **(05 Marks)**

b. Explain the various factors affecting the performance of a vapour compression system. **(04 Marks)**

c. A vapour compression refrigerator uses methyl chloride (R-40) and operates between temperature limits of $-10^{\circ}C$ and $45^{\circ}C$. At the entry to the compressor, the refrigerant is dry and after compression it acquires a temperature of $60^{\circ}C$. Find the C.O.P of the refrigerator. **(07 Marks)**

OR

8 a. Define the following terms:
(i) Dry bulb temperature (DBT).
(ii) Wet bulb temperature (WBT)
(iii) Specific humidity.
(iv) Relative humidity. **(08 Marks)**

b. Atmospheric air at 101.325 KPa has $30^{\circ}C$ DBT and $15^{\circ}C$ DPT. Without using the psychromatic chart, using the property values from the tables. Calculate
(i) Partial pressure of air and water vapour.
(ii) Specific humidity
(iii) Relative humidity.
(iv) Vapour density and enthalpy of moist air. **(08 Marks)**

Module-5

9 a. Obtain expression for volumetric efficiency of a single stage air compressor in terms of pressure ratio, clearance and 'n' the polytropic index. **(06 Marks)**

b. What are disadvantages of a single stage air compressor? **(02 Marks)**

c. A two stage air compressor with perfect intercooling takes in air at 1 bar $27^{\circ}C$. The law of compression in both the stages is $PV^{1.3}$ = constant. The compressed air is delivered at 9 bar. Calculate for unit mass flow rate of air the minimum workdone and the heat rejected to the intercooler. Compare the values if the compression is carried out in single stage compressor with after cooler. **(08 Marks)**

OR

10 a. Mention the types of nozzles. Explain any one. **(04 Marks)**

b. Derive an expression for steam velocity coming out from a nozzle. **(04 Marks)**

c. Dry saturated steam at a pressure of 11 bar enters a convergent-divergent nozzle and leaves at a pressure of 2 bar. If the flow is adiabatic and frictionless, determine
(i) The exit velocity of steam.
(ii) Ratio of cross section at exit and that at throat. **(08 Marks)**
Assume the index of adiabatic expansion is 1.135.

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CBCS Scheme

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15ME44

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Fluid Mechanics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define the following properties of fluid with their units :
i) Mass density ii) Dynamic viscosity iii) Surface tension **(06 Marks)**

b. Determine the specific gravity of a fluid having a kinematic viscosity of the 0.04 stoke and dynamic viscosity of 0.05 poise. **(04 Marks)**

c. An oil film of thickness 115mm is used for used for lubricating between a square plate of size 0.8m × 0.8m and an inclined plane having an exclinition of 30° with the horizontal. The weight of the square plate is 300N and slides down the plane with a uniform velocity of 0.3m/s. Find the dynamic viscosity of oil. **(06 Marks)**

OR

2 a. Define : i) Bouyancy ii) Meta centre. **(02 Marks)**

b. Derive an expression for total pressure force and depth of centre of pressure for a vertical surface submerged in water. **(08 Marks)**

c. A solid cylinder of diameter 4m has a height of 3m. Find the meta centre height when it is floating in water with its axis vertical. The Specific gravity of cylinder is 0.6. **(06 Marks)**

Module-2

3 a. Explain the two different fluid flow analysis method with suitable example. **(06 Marks)**

b. The velocity potential for 0 is given by $0 = -\frac{xy^3}{3} - x^2 + \frac{x^3y}{3} + y^2$

Calculate the velocity components in the X and Y direction. Check the possibility of such a flow. **(10 Marks)**

OR

4 a. Derive Euler's equation of motion for a steady flow and deduce Bernoullis equation. **(10 Marks)**

b. A horizontal venturimeter with inlet dia. 20cm and throat diameter 10cms is used to measure the flow of water. The pressure at inlet is 17.658 N/cm^2 and Vaccum pressure at the throat is 30cms of mercury. Find the discharge of water through venture meter $C_d = 0.9$. **(06 Marks)**

Module-3

5 a. Define Reynolds number. What is its significance? List the characteristic of laminar flow. **(08 Marks)**

b. A crude oil of viscosity 0.97 per sec and specific gravity 0.9 is flowing through a horizontal circular pipe of diameter of 0.1m and length 10m. Calculate the difference of pressure at two ends of the pipe if 100kg is collected in a tank in 0.5 minutes. Assume laminar flow. **(08 Marks)**

OR

6 a. Derive the Darcy Weisbach equation. **(08 Marks)**

b. A 10cm diameter pipe takes off abruptly from a large tank and run 5m, then expands to 20cm diameter abruptly and runs 50m and next discharge directly to open air with a velocity of 25m/s. Calculate the height of water surface above point of discharge. Take Darcy's coefficients 0.0065. **(08 Marks)**

Module-4

7 a. Define :
   i) Displacement thickness
   ii) Momentum thickness
   iii) Energy thickness
   iv) Shape factor as with respect to boundary layer. **(08 Marks)**

b. A man descends the ground from an airoplane with help of a parachute, which is hemispherical having a diameter of 5m against the resist of air with a uniform velocity of 25m/s. Find the weight of the man if the weight of parachute is 9.81, CD = 0.6. **(08 Marks)**

OR

8 a. Explain the different types of similitude. **(08 Marks)**

b. Assume the viscous force F exerted by a fluid on sphere of diameter D, depends on viscosity μ of mass density ρ and velocity of motion of the sphere, obtain the expression for shear force F, using Buckingham's π – theorem method. **(08 Marks)**

Module-5

9 a. Define: i) Mach line ii) Mach angle iii) Subsonic and supersonic flow. **(08 Marks)**

b. Calculate the velocity and Mach number of a supersonic aircraft flying at an altitude of 1200m when temperature is 300K. Sound of aircraft is heard 2 seconds after passage of aircraft over the head of an observer. Take r = 1.41, R = 287 J/kg/k. **(08 Marks)**

OR

10 a. Write short essay on the engineering application of CFD, brining the advantages and the limitations. **(08 Marks)**

b. Define the following terms and write the relevant equations for the same : -
   i) Stagnation Temperature
   ii) Stagnation Pressure. **(08 Marks)**

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15MEB406/15ME46B

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Mechanical Measurements and Metrology

Time: 3 hrs. Max. Marks: 80

Note: ***Answer FIVE full questions, choosing one full question from each module.***

Module-1

1 a. State the objectives of Metrology. **(04 Marks)**

b. Explain with a neat sketch International Prototype meter. **(06 Marks)**

c. Using M112 set of slip gauges, build the following dimensions :
i) 48.3275 ii) 68.208. **(06 Marks)**

OR

2 a. Four length bars A, B, C & D of approximately 250mm each are to be calibrated with standard calibrated metre bar which is actually 0.0008mm less than a metre. It is also found that bar B is 0.0002mm longer than bar 'A' bar 'C' is 0.0004mm longer than 'A' and bar 'D' is 0.0001mm shorter than bar 'A'. The length of all four bars put together is 0.0003mm longer than the calibrated standard metre. Determine the actual dimension of each bar. **(10 Marks)**

b. Explain with a neat sketch the method of measuring taper angles using sine centre. **(06 Marks)**

Module-2

3 a. Differentiate : i) Clearance fit and Interference fit ii) Unilateral and Bilateral tolerance. **(08 Marks)**

b. Explain Hole basis system and Shaft basis system. **(08 Marks)**

OR

4 a. Illustrate with a neat sketch, the working of a sigma comparator. **(08 Marks)**

b. With a neat sketch, explain the construction and principle of Solex Pneumatic Comparator. **(08 Marks)**

Module-3

5 a. Explain the two wire method to find the effective diameter of screw thread. **(06 Marks)**

b. With a sketch, explain the construction of a tool maker's microscope. What are its applications? **(08 Marks)**

c. What is Best Wire Size? **(02 Marks)**

OR

6 a. Sketch and explain co-ordinate measuring machine. **(06 Marks)**

b. What are Tactile sensors? Explain different types of tactile sensors. **(06 Marks)**

c. Explain the principle of Inferometry. **(04 Marks)**

Module-4

7 a. Explain the working of generalized measurement system with block diagram taking the example. **(06 Marks)**

b. Define the following terms, with reference to measuring systems :
i) Threshold ii) Hysteresis. **(04 Marks)**

c. Distinguish between :
i) Primary & Secondary transducer ii) Active & Passive transducer. **(06 Marks)**

OR

8 a. State and explain any four Inherent problems associated in mechanical systems. **(08 Marks)**
b. State any four terminating devices. Explain any two. **(08 Marks)**

Module-5

9 a. With a neat sketch, describe the Bridgeman gauge used for pressure measurement. **(08 Marks)**
b. How are dynamometers classified? Explain with a neat sketch, Prony brake dynamometer. **(08 Marks)**

OR

10 a. Explain the working principle of radiation pyrometer. **(06 Marks)**
b. Illustrate the working of Electrical resistance strain gauge. **(04 Marks)**
c. Briefly explain the laws of Thermocouple. **(06 Marks)**

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10ME/AU43

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018

Applied Thermodynamics

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

2. ***Use of thermodynamic data handbook is permitted.***

PART – A

1 a. With a neat sketch, explain the analysis of exhaust gases by Orsat apparatus. **(10 Marks)**

b. Methane (CH_4) is burned with atmospheric air. The analysis of the products on a 'dry' basis is as follows: CO_2 = 10%, O_2 = 2.37%, CO = 0.53%, N_2 = 87.10%.

i) Determine the combustion equation.

ii) Calculate the air-fuel ratio.

iii) Percent theoretical air. **(10 Marks)**

2 a. Derive the expression for the air standard efficiency of a diesel cycle with usual notations. State the assumptions made and represent the process on P-V and T-S diagram. **(10 Marks)**

b. A 4-stroke dual fuel cycle operates on 10 liters of air at 1 bar and 27°C per cycle. The addition of heat at constant volume is adjusted for a maximum pressure in the cycle of 70 bar. The heat addition continuous for 5% of the stroke. Calculate:

i) Pressure ratio ii) Heat added per cycle

iii) Cut-off ratio iv) Heat rejected per cycle

v) Net work done vi) Thermal efficiency

vii) Power developed, when engine runs at 200 rpm. **(10 Marks)**

3 a. Briefly explain how the indicated power of a multi-cylinder is measured. **(06 Marks)**

b. Write a short note on heat balance sheet. **(04 Marks)**

c. In a constant speed CI engine operating on 4-stroke cycle and fitted with a hand brake. The following observations were taken:

Brake wheel diameter = 600 mm
Band thickness = 5 mm
Speed = 450 rpm
Load on band = 200 N
Spring balance reading = 30 N
Area of indicator diagram = 415 mm^2
Length of the indicated diagram = 63 mm
Spring number = 0.11 N/mm^2 per mm
Bore = 100 mm
Stroke = 150 mm
Specific fuel consumption = 0.22 kg/KW-hr
Calorific value of fuel = 42000 kJ/kg.

Determine:

i) Brake power ii) Indicated power iii) Mechanical efficiency

iv) Indicated thermal efficiency v) Brake thermal efficiency **(10 Marks)**

4 a. With the help of a schematic diagram and T-S diagram, explain the working of a regenerative vapour power cycle and derive an expression for its overall efficiency. **(12 Marks)**

b. In a steam power cycle, the steam supply is at 15 bar and dry and saturated. The condenser pressure is 0.4 bar. Calculate the Carnot and Rankine efficiency of the cycle. Neglect pump work. **(08 Marks)**

PART – B

5 a. Derive the expression for the work done for a single stage single acting reciprocating compressor with clearance volume. **(06 Marks)**

b. Discuss applications of compressed air, and derive an expression for the volumetric efficiency of reciprocating air compressor. **(06 Marks)**

c. A single stage double acting air compressor is required to deliver 14 m^3 of air per minute measured at 1.013 bar and 15°C. The delivery pressure is 7 bar and the speed is 300 rpm. Take the clearance volume as 5% of the swept volume with compression and expansion index of n = 1.3. Calculate:
i) Swept volume of the cylinder
ii) The delivery temperature
iii) Indicated power. **(08 Marks)**

6 a. Derive an expression for the work output of a gas turbine in terms of pressure ratio and maximum and minimum temperature T_3 and T_1. Hence show that the pressure ratio for maximum specific work output is given by $R_p = \left[\frac{T_3}{T_1}\right]^{\frac{\gamma}{2(\gamma-1)}}$. **(12 Marks)**

b. In a simple gas turbine cycle, the compressor pressure ratio is 8:1. The maximum cycle temperature is 827°C. If the compressor inlet conditions are 1 bar and 27°C. Determine per unit mass of air.
i) Compressor work ii) Turbine work iii) Work ratio
iv) Cycle efficiency v) Specific air consumption in kg/hr. **(08 Marks)**

7 a. With a neat sketch describe clearly the working of a vapour absorption refrigeration system. **(08 Marks)**

b. Write a brief note on properties of refrigerants. **(04 Marks)**

c. A simple vapour compression plant produces 5 tonnes of refrigeration. The enthalpy values at inlet to compressor, at exit from the compressor, and at exit from the condenser are 183.19, 209.41 and 74.59 kJ/kg respectively. Estimate:
i) The refrigerant flow rate
ii) The COP
iii) The power required to drive the compressor and
iv) The rate of heat rejection to the condenser. **(08 Marks)**

8 a. Define: i) Saturated air ii) Dry bulb temperature iii) Dew point temperature
iv) Relative humidity v) Specific humidity **(05 Marks)**

b. Explain briefly:
i) Summer air conditioning
ii) Winter air conditioning **(08 Marks)**

c. The sling psychrometer in a laboratory test recorded the following readings: Dry bulb temperature = 35°C, wet bulb temperature = 25°C. Calculating the following:
i) Specific humidity
ii) Relative humidity
iii) Vapour density in air.
Take atmosphere pressure = 1.0132 bar. **(07 Marks)**

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10ME/AU44

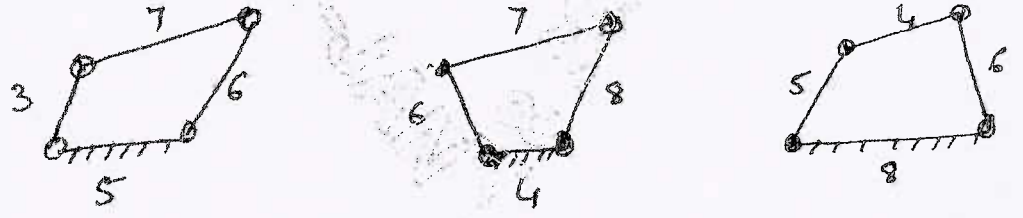
Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Kinematics of Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Fig. Q1 shows four link mechanism is which the figure indicates the dimensions in standard units of length. Indicate the type of each mechanism whether crank rocker or double crank or double rocker. **(09 Marks)**



(i) (ii) (iii)

Fig Q1(a)

b. Differentiate between: i) Lower pair and higher pair ii) Closed pair and unclosed pair iii) Turning pair and rolling pair. **(06 Marks)**

c. What is meant by Inversion? Discuss any one inversion of a double slider crank chain. **(05 Marks)**

2 a. Sketch a Paucellier mechanism, show that it can be used to trace a straight line on the movement of links. **(10 Marks)**

b. With help of a neat diagram, discuss the working of Toggle mechanism. **(08 Marks)**

c. Differentiate between exact straight line and approximate straight line mechanism. **(02 Marks)**

3 A crank and rocker mechanism ABCD has the following dimensions :
AB = 0.75m, BC = 1.25m, CD = 1m, AD = 1.5m, BE = 437.5mm CE = 875mm. E is the point on coupler link BC, AD is fixed link, BEC is read clockwise, crank AB has an angular velocity of 20.94r/s counterclockwise and retardation of 280 r/s^2 at the instant $\angle DAB = 60°$, find :

i) The instantaneous velocity and acceleration of point C and E

ii) Angular velocity and acceleration of link BC. **(20 Marks)**

4 a. What is instantaneous centre of rotation of a body? Discuss different types of instantaneous centers. **(06 Marks)**

b. The lengths of the crank and connecting rod of a horizontal reciprocating engine are 100mm and 500mm respectively. The crank is rotating at 400rpm. Using Klein's construction, find : i) Velocity and acceleration of piston ii) angular velocity and angular acceleration of connecting rod when the crank has turned 30° from the inner deed centre. **(14 Marks)**

PART – B

5 In a four bar mechanism the dimensions of the links are as under AB = 50mm, BC = 66mm, CD = 56mm, AD = 100mm (fixed link).

At an instant when $D\hat{A}C = 60°$ the angular velocity of the input link AB is 10.5 rad/sec is the counterclockwise direction with an angular retardation of 26 rad/s^2. Determine analytically the angular displacement, angular velocity and angular acceleration of link DC and BC. **(20 Marks)**

6 a. What do you mean by the phenomenon, 'Interference' between two mating gears? **(02 Marks)**

b. Find the expression for the minimum number to teeth on the wheel if interference is to be avoided between two mating gears. **(12 Marks)**

c. A pinion and rack are is mesh. The rack is driven by a pinion of 125mm pitch circle diameter. The numbers of involute teeth on the pinion are 20. The addendum of both pinion and rack is 6.25mm. If interference is to be avoided, determine pressure angle. **(06 Marks)**

7 Fig Q7 shows epicyclic gear train pinion A has 15 teeth, and rigidly fixed to the motor shaft. The wheel B has 20 teeth and gears with A and also with the annular wheel D which is fixed. Pinion C is having 15 teeth and is integrated with B (B and C are compound wheel) Gear C meshes with the annular wheel E which is keyed to the machine shaft. The arm rotates about the same shaft on which A is fixed and carries the compound wheel B and C. If motor runs at 1000rpm find the speed of machine shaft and the torque exerted on the machine shaft if motor develops a torque of 100 Nm. **(20 Marks)**

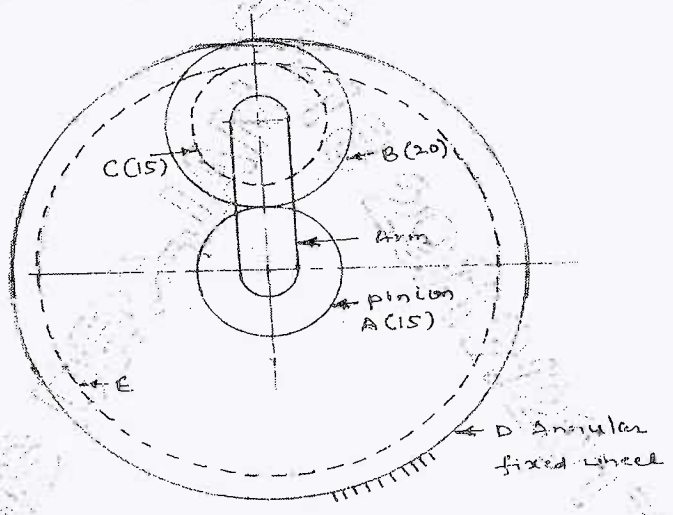


Fig Q7

8 a. Define and explain :
i) Cam profile ii) Base circle iii) Prime circle iv) Pitch curve. **(04 Marks)**

b. Draw the profile of cam to raise a valve with harmonic motion through 40mm is $\frac{1}{4}^{th}$ of revaluation, keep it fully raised through $\frac{1}{10}^{th}$ of the revolution and to lower with uniform acceleration and retardation motion is $\frac{1}{6}^{th}$ of revolution. The valve remains closed during rest of the revolution. The diameter of the roller is 20mm, minimum radius cam is 30mm. The axis of the valve rod passes through the axis of cam shaft. Assume that cam rotates is counterclockwise. **(16 Marks)**

CBCS SCHEME

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15MEB406

Fourth Semester B.E. Degree Examination, June/July 2018
Mechanical Measurements and Metrology

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. What is a material standard? List out the advantages of wavelength standard **(06 Marks)**

b. Explain about subdivisions of standards. **(04 Marks)**

c. A calibrated meter bar has an actual length of 1000.0008mm. It is to be used in the calibration of two bars A and B each having a length of 500mm when compared with meter bar $L_A + L_B$ was found to be shorter by 0.0004mm. In comparing A with B it was found that A was 0.0006mm longer than B. Find the actual length of A and B. **(06 Marks)**

OR

2 a. How do you specify sine bar and explain why it is not preferred to measure greater than 45°. **(05 Marks)**

b. What are slip gauges? Explain about wringing of slip gauge and care of slip gauge. **(05 Marks)**

c. Using M112 set, of slip gauges build the following dimension with protector blocks at both ends of 2mm blocks individually i) 29.758 ii) 57.895. **(06 Marks)**

Module-2

3 a. Define:
- i) Basic hole
- ii) Selective assembly
- iii) Allowance
- iv) Tolerance
- v) Fundamental deviation **(05 Marks)**

b. Why shaft basis system is not preferred? **(03 Marks)**

c. Design the gauges to check $50C_7$ the F.D. for $C = 0.52D^{0.2}$. The diameter falls in the step of 30-50mm. The quality for grade 7 is 16i where $i = 0.45\sqrt[3]{D} + 0.001D$. **(08 Marks)**

OR

4 a. Illustrate with a neat sketch, the working of Zeiss optimeter. **(06 Marks)**

b. Classify the different comparator and explain the functional requirements. **(04 Marks)**

c. Differentiate measuring instruments, gauges and comparators. **(06 Marks)**

Module-3

5 a. Explain the three wire method to find the effective diameter of screw thread. **(06 Marks)**

b. List out the various methods of measuring the gear tooth thickness explain any one of it. **(08 Marks)**

c. What do you mean by pressure angle of a Gears? **(02 Marks)**

OR

6 a. List the various coordinates measuring machines. Sketch, and explain coordinate measuring machine. **(06 Marks)**

b. With a neat sketch explain about laser interferometer. **(06 Marks)**

c. List out applications of tool makers microscope. **(04 Marks)**

Module-4

7 a. Define: i) Accuracy ii) Precision iii) Loading effect iv) Calibration v) Error. **(05 Marks)**

b. Explain the working of generalized measurement system with block diagram taking one of the examples. **(06 Marks)**

c. Discuss briefly about LVDT. **(05 Marks)**

OR

8 a. Discuss briefly about electronic amplifiers. **(08 Marks)**

b. What are terminating devices? Explain in detail CRO. **(08 Marks)**

Module-5

9 a. Sketch a proving ring and explain how it is used for force measurement. **(05 Marks)**

b. How are dynamometers classified? Explain with a sketch rope brake dynamometer. **(05 Marks)**

c. With a neat sketch explain Mcleod gauge used for pressure measurement. **(06 Marks)**

OR

10 a. Discuss about temperature compensation in strain gauges. **(06 Marks)**

b. List out materials used for thermocouples. **(04 Marks)**

c. Explain the working principle of optical pyrometer. **(06 Marks)**

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10MEB406/10AUB406

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018

Fluid Mechanics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Distinguish between dynamic viscosity and kinematic viscosity and explain the effect of temperature on viscosity of liquids and gases. **(06 Marks)**

b. Explain:
i) Why in a capillary tube meniscus of water is concave upwards while the meniscus of mercury is convex upwards?
ii) Why concept of surface tension is not applied to gases? **(06 Marks)**

c. A stationary bearing of length 30 cm and internal radius 8.025 cm has been used to provide lateral stability to a 8 cm radius shaft rotating at constant speed of 200 rpm. The space between the shaft and the bearing is filled with a lubricant of viscosity 2.5 poise. Find the power utilized in overcoming the frictional torque. Take the velocity profile as linear. **(08 Marks)**

2 a. Define:
i) Hydrostatic law
ii) Vacuum pressure
iii) Total pressure and centre of pressure **(06 Marks)**

b. A U-tube manometer is used to measure the pressure of water in a pipe line, which is in excess of atmospheric pressure. The right limb of manometer contains mercury and is open to atmosphere. The contact between water and mercury is in the left limb. Determine the pressure of water in the main line if the difference in level of mercury in the limbs of U-tube is 10 cm and the free surface of mercury is in level with the centre of pipe. If the pressure of water in the pipeline reduces to 10 kN/m^2. Calculate the new difference in the level of mercury. Take specific weight of water as 10 kN/m^3. **(08 Marks)**

c. A pipe line which is 4 m in diameter contains a gate valve. The pressure at the centre of the pipe 19.6 N/cm^2. If pipe is filled with oil of specific gravity 0.87. find the force exerted by the oil on the gate and position of centre of pressure. **(06 Marks)**

3 a. Derive an expression for metacentric height of a floating body. **(08 Marks)**

b. Define the terms:
i) Velocity potential function
ii) Stream function **(04 Marks)**

c. A fluid flow field is given by $V = x^2y\,\vec{i} + y^2z\,\vec{j} - (2xyz + yz^2)\vec{k}$. Prove that it is a possible case of steady incompressible fluid flow. Calculate the velocity and acceleration at the point (2, 1, 3) **(08 Marks)**

4 a. Derive Euler's equation of motion along a stream line and obtain Bernoulli's equation from it. **(08 Marks)**

b. A jet of water from a 25 mm diameter nozzle is directed vertically upwards. Assuming that the jet remains circular and neglecting any loss of energy, what will be the diameter at a point 4.5 m above the nozzle, if velocity with which jet leaves the nozzle is 12 m/s? **(06 Marks)**

c. A 2m long pipe line tapers uniformly from 10 cm diameter to 20 cm diameter at its upper end. The centre line of pipe slopes upwards at an angle of 30° to the horizontal and flow direction is from smaller to bigger cross section. If the pressures at lower and upper end are 200 kPa and 230 kPa respectively, determine the flow rate and the fluid pressure at the mid length of the pipe line. Assume no energy losses. **(06 Marks)**

PART – B

5 a. Derive an expression for discharge through an orifice-meter. **(08 Marks)**

b. Define the following dimensionless numbers:
   i) Reynold's number
   ii) Froude's number **(04 Marks)**

c. The pressure difference 'Δp' in a pipe of diameter D and length 'l' due to viscous flow depends on velocity V, viscosity μ and density ρ. Using Buckingham's π theorem, obtain an expression for Δp. **(08 Marks)**

6 a. What do you understand by major energy loss and minor energy losses in pipes? **(04 Marks)**

b. Derive an expression for loss of head due to sudden enlargement. **(08 Marks)**

c. A pipe line 300 mm in diameter and 3200 m long is used to pump 50 kg/sec of an oil whose density is 950 kg/m^3, and whose kinematic viscosity is 2.1 stokes. The centre of the pipe line at the upper end is 40 m above the lower end. The discharge at the upper end is atmospheric. Find the pressure at the lower end and draw the hydraulic gradient and total energy line. **(08 Marks)**

7 a. Prove that velocity distribution for flow between two parallel stationary plates is parabolic and also prove that maximum velocity is equal to one and half times the average velocity. **(10 Marks)**

b. A laminar flow is taking place in a pipe of diameter of 200 mm. The maximum velocity is 1.5 m/s. Find the mean velocity and the radius at which this occurs. Also calculate the velocity at 4 cm from the wall of the pipe. **(10 Marks)**

8 a. Explain the terms:
   i) Lift and drag
   ii) Momentum thickness
   iii) Sonic and subsonic flow **(06 Marks)**

b. Define Mach number. What is the significance of Mach number in compressible fluid flows? **(04 Marks)**

c. An aeroplane weighing 40 kN is flying in a horizontal direction at 360 km/hr. the plane has a wing surface area of 35 m^2. Determine the lift coefficient and the power required to drive the plane. Assume drag coefficient $C_D = 0.03$ and for air $\rho = 1.20$ kg/m^3. **(06 Marks)**

d. A projectile travels in air of pressure 10.1043 N/cm^2 at 10°C at a speed of 1500 km/hr. Find the Mach number and Mach angle. Take K = 1.4 and R = 287 J/kgK. **(04 Marks)**

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15ME33

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Basic Thermodynamics

Time: 3 hrs. Max. Marks: 80

Note: 1. *Answer FIVE full questions, choosing one full question from each module.*
2. *Use of thermodynamic data book is permitted.*

Module-1

1 a. Define the following with examples: (i) Open system (ii) Closed system (iii) Isolated system. **(06 Marks)**

b. List out similarities and dissimilarities between work and heat. **(04 Marks)**

c. The temperature t on a Celsius thermometer scale is defined interms of property P by the relation $p = e^{(t-B)/A}$ where A and B are constants. At ice and steam points the value of p is 1.86 and 6.81 respectively. Find the value of 't' for p = 2.5. **(06 Marks)**

OR

2 a. With examples, distinguish between :
(i) Intensive property and extensive property.
(ii) Point function and path function. **(04 Marks)**

b. Obtain an expression for work done by the isothermal process. **(04 Marks)**

c. A fluid in a horizontal cylinder fitted with a frictionless leak proof piston is continuously agitated by means of stirrer passing through the cylinder cover. The cylinder diameter is 400 mm. During a stirring process of 10 minutes, the piston moves slowly outwards to a distance of 485 mm against the atmospheric pressure. The net work done by the fluid during this process is 2000 Nm. Given that the speed of electric motor driving the stirrer is 840 rpm, estimate the torque required in driving the shaft and shaft output of the motor. **(08 Marks)**

Module-2

3 a. State the first law of thermodynamics applied to cyclic and non-cyclic processes. **(04 Marks)**

b. What is PMMK2? Why is it impossible? **(04 Marks)**

c. A centrifugal pump delivers 50 kg of water per second. The inlet and outlet pressures are 1 bar and 4.2 bar. The suction is 2.2 m below the centre of the pump and delivery is 8.5 m above the centre of the pump. The suction and delivery pipe diameter are 20 cm and 10 cm respectively. Determine the capacity of the electric motor to run the pump if pump efficiency is 85%. **(08 Marks)**

OR

4 a. Give Kelvin-Planck and Clausius statements of second law of thermodynamics. **(04 Marks)**

b. Show that for constant pressure process, the heat transfer is equal to change in enthalpy. **(04 Marks)**

c. Two Carnot engines work in series beween the source and sink temperatures of 550 K and 350 K. If both engines develop equal power, determine the intermediate temperature. **(08 Marks)**

Module-3

5 a. Explain how free expansion and friction makes the process irreversible. **(08 Marks)**

b. 0.12 m^3 of air at 1 bar and 120°C is compressed to $\frac{1}{10}$ of the original volume and a pressure of 35 bar. Heat is then added at constant pressure until the volume is doubled. Determine the change of entropy during each of these process. Take $C_p = 1.005$ kJ/kgK, $C_v = 0.7165$ kJ/kgK, $R = 0.287$ kJ/kgK. **(08 Marks)**

OR

6 a. What is internal and external irreversibility? **(03 Marks)**

b. Show that entropy is a property of a system. **(06 Marks)**

c. A heat engine receives 300 kJ/min of heat from a source at 327°C and rejects heat to a sink at 27°C. Three hypothetical amounts of heat rejections are given below (i) 200 kJ/min (ii) 150 kJ/min (iii) 100 kJ/min. From these results state which of these cases is a reversible cycle, irreversible cycle and impossible one. **(07 Marks)**

Module-4

7 a. Define available and unavailable energy. **(04 Marks)**

b. Draw phase equilibrium diagram for water on P-V coordinates and indicate relevant parameters on it. **(04 Marks)**

c. Write a note on Maxwell relations. **(08 Marks)**

OR

8 a. With a neat sketch, explain the working of combined separating and throttling calorimeter. **(08 Marks)**

b. Steam at 10 bar and dry state is cooled under constant pressure until it becomes 0.85 dry. Using steam tables, find the work done, change in enthalpy, heat transferred and change in entropy. **(08 Marks)**

Module-5

9 a. Give the statement of. (i) Dalton's law of additive pressures (ii) Amagat's law of volume additives. **(04 Marks)**

b. With usual notations, write the Beattie-Bridgeman equation of state. **(04 Marks)**

c. A mixture of ideal gas consists of 3 kg of N_2 and 5 kg of CO_2 and at a pressure of 300 kPa and temperature of 20°C. Find (i) Mole fraction of each constituent (ii) Equivalent gas constant of the mixture (iii) Equivalent molecular weight (iv) Partial pressures and volumes. **(08 Marks)**

OR

10 a. State and explain law of corresponding states. **(04 Marks)**

b. Define the following:

(i) Dry bulb temperature.
(ii) Wet bulb temperature.
(iii) Specific humidity.
(iv) Dew point temperature **(04 Marks)**

c. Determine the pressure in a steel vessel having a volume of 15 lit and containing 3.4 kg of N_2 at 400°C using (i) Ideal gas equation (ii) Vander-Waals equation. Also calculate the compressibility factor by using the answer obtained from the Vander –Waals equation of state. **(08 Marks)**

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CBCS Scheme

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15ME/MA34

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define :
i) Hooke's law ii) Poisson's ratio iii) Factor of safety
iv) Bulk modulus v) Modulus of elasticity. **(05 Marks)**

b. Draw and explain stress-strain diagram of a mild steel specimen subjected to tension test. **(05 Marks)**

c. A circular rod of 100mm diameter and 500mm length is subjected to a tensile load of 1000kN. Determine the i) Modulus of rigidity ii) Bulk modulus iii) Change in volume. Take Poisson's ratio = 0.30 and E = 200GPa. **(06 Marks)**

OR

2 a. Define :
i) Elasticity ii) Plasticity iii) Resilience iv) Toughness v) Stiffness. **(05 Marks)**

b. Derive a relation between modulus of elasticity and bulk modulus. **(05 Marks)**

c. A bar of brass 25mm diameter is enclosed in a steel tube of 50mm external diameter and 25mm internal diameter. The bar and the tube fastened at the ends and are 1.5m long. Find the stresses in the two materials when the temperature raises from 30°C to 80°C.
Take : E_{steel} = 200 GPa ; E_{brass} = 100GPa,
$\alpha_{steel} = 11.6 \times 10^{-6}/°C$; $\alpha_{brass} = 18.7 \times 10^{-6}/°C$. **(06 Marks)**

Module-2

3 a Derive an expression for normal stress, shear stress and resultant stress on an oblique plane inclined at an angle θ with vertical axis (x-plane) in a biaxial stress system subjected to σ_x, σ_y and τ_{xy} also find angle of obliquity ϕ. **(10 Marks)**

b. Derive expressions for hoop stress and longitudinal stress for a thin cylinder subjected to internal fluid pressure. **(06 Marks)**

OR

4 a. A point in a strained material in subjected to a tensile stress of 500N/mm^2 and 300N/mm^2 in two mutually perpendicular planes and also these planes carries a shear stress of 100N/mm^2. Calculate the normal, tangential, resultant stresses (σ_0, τ_θ, σ_r) on a plane making an angle of 30° with the vertical axis (x-plane). Also find principal stresses. **(10 Marks)**

b. A thin cylindrical shell 1.2m in diameter and 3m long has a metal wall thickness of 12mm. It is subjected to an internal pressure of 3.2MPa. Find the circumferential and longitudinal stress in the wall. Also determine change in volume of the cylinder. Assume E = 210 GPA and μ = 0.30. **(06 Marks)**

Module-3

5 For the beam shown in Fig. Q5. Draw shear force and bending moment diagrams. Locate the point of contraflexure if any. **(16 Marks)**

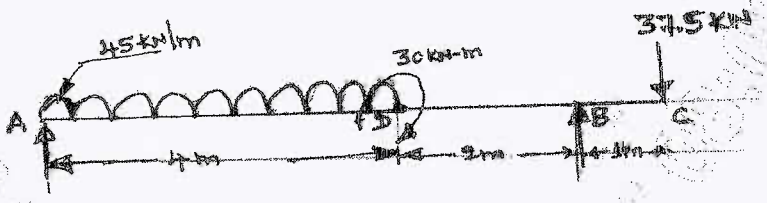

Fig Q5

OR

6 a. Derive the relationship between load shear force and bending moment for UDL. **(04 Marks)**

b. List the assumptions made in theory of pure bending. Write the bending equation with usual notations with their meanings. **(06 Marks)**

c. Derive an expression relating slope, deflection and radius of curvature in a beam in terms of E, I an M with usual notations. **(06 Marks)**

Module-4

7 a. State the assumption made in pure torsion and derive $\frac{T}{J_p} = \frac{G\theta}{L} = \frac{\tau}{R}$ with usual meanings. **(08 Marks)**

b. A 1.5m long column has circular cross section of 50mm diameter. One end of the column is fixed in direction and position and the other end is free. Taking the factor of safety as 3 calculate :

i) Safe load according to Rankine's formula taking $\sigma_c = 560MPa$ and $\alpha = \frac{1}{1600}$

ii) Safe load according to Euler's formula taking $E = 120GPa$. **(08 Marks)**

OR

8 a. State the assumptions made while deriving Euler's column formula. Also derive Euler's expression of buckling load for column with both ends hinged. **(08 Marks)**

b. A solid circular shaft has to transmit a power of 1000 kW at 120rpm. Find the diameter of the shaft if the shear stress of the material must not exceed $80N/mm^2$. The maximum torque is 1.25 times the mean torque. If this solid shaft is replaced by hollow one whose internal diameter is 0.6 times its external diameter, find diameter of hollow shaft. **(08 Marks)**

Module-5

9 a. Explain: i) Castigliano's first theorem ii) Castigliano's second theorem. **(08 Marks)**

b. Write a note on :

i) Maximum principal stress theory ii) Maximum shear stress theory. **(08 Marks)**

OR

10 a. A hollow circular shaft of 2m length has an external diameter of 100mm and a thickness of 10mm. If it is subjected to a torque of 10kN-m, determine the strain energy stored in the shaft. Take G= 80Gpa. **(04 Marks)**

b. The plane state of stress at a point is given $\sigma_x = 70MPa$; $\sigma_y = 140MPa$; $\tau_{xy} = -35MPa$. If the yielding stress in tension in 175MPa, check whether there is failure according to

i) Maximum principal stress theory

ii) Maximum shear stress theory

If the material is safe then find the factor of safety. **(12 Marks)**

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CBCS Scheme

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15ME35B

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Machine Tools and Operations

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. What is Drilling, sketch and explain the common parts of a Radial Drilling Machine. **(08 Marks)**

b. Define Milling. Differentiate between up milling and down milling with neat sketch. **(08 Marks)**

OR

2 a. With a suitable sketch, explain the working principle of centerless grinding Machine. **(08 Marks)**

b. List out the differences between shaper and planer. **(08 Marks)**

Module-2

3 a. With a suitable, sketch, explain the following milling operations.
i) Gang milling ii) Saw milling. **(08 Marks)**

b. Draw and explain the following operations using drilling machine.
i) Reaming ii) Counter Boring. **(08 Marks)**

OR

4 a. Describe the properties of the cutting tool materials and types of cutting tool materials. **(08 Marks)**

b. A work piece of diameter 38mm and Length 400mm was turned on a lathe using a suitable cutting tool. Determine the machining time to reduce the work piece to 36.5mm diameter is one pass with cutting speed of 30mpm and forced 0.7mm/rev. **(08 Marks)**

Module-3

5 a. With suitable sketch, elaborate the types of operations performed on a Turret Lathe. **(08 Marks)**

b. Sketch and explain in brief the process of Gear milling and thread milling operations. **(08 Marks)**

OR

6 a. What is Grinding, with a suitable sketch, Describe vertical spindle grinding machine, with reciprocating table. **(08 Marks)**

b. State the functions of cutting fluid. Briefly, explain the properties of cutting fluids. **(08 Marks)**

Module-4

7 a. Define Indexing. With suitable sketch describe simple indexing mechanisms. **(08 Marks)**

b. Draw and explain the driving mechanism of a bench drilling machine. **(08 Marks)**

OR

8 a. Define the following terms :
   i) Cutting speed
   ii) Feed
   iii) Depth of cut
   iv) Machining time with equations for turning operations. **(08 Marks)**

   b. Calculate the required rpm of work piece of 100mm diameter to provide a cutting speed to 50mpm. Also find machining time of length of work is 400mm and feed is 0.4mm/rev. **(08 Marks)**

Module-5

9 a. What do you mean by the term chip formation? Describe types of chips with a neat sketch. **(08 Marks)**

   b. With a suitable sketch. Describe orthogonal and oblique cutting operations. **(08 Marks)**

OR

10 a. Define Tool wear. Explain the following terms :
   i) Crater wear
   ii) Flank wear **(08 Marks)**

   b. Explain the terms Tool failure and Tool life. Describe the effects of cutting parameter on Tool life. **(08 Marks)**

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CBCS Scheme

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Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Metal Casting and Welding

Time: 3 hrs. Max. Marks: 80

Note: *Answer FIVE full questions, choosing one full question from each module.*

Module-1

1 a. What is Casting? Briefly discuss steps involved in making of castings. **(06 Marks)**
b. What is Pattern? What are the functions of pattern? **(04 Marks)**
c. What are the different allowance given to the pattern? Explain briefly. **(06 Marks)**

OR

2 a. What are the ingredients of moulding sand? Explain briefly. **(04 Marks)**
b. With a neat sketch, explain Shell moulding process. **(06 Marks)**
c. Describe the working operation of squeeze type moulding machine. **(06 Marks)**

Module-2

3 a. What are the zones in cupola? With a neat sketch, explain cupola furnace. **(08 Marks)**
b. What is the principle of Electric Arc Furnace? Explain with sketch. **(08 Marks)**

OR

4 a. Differentiate between Gravity and pressure die casting. **(04 Marks)**
b. With a neat sketch, explain the working principle of Hot – Chamber die casting method. **(06 Marks)**
c. Explain with neat sketch, Centrifugal casting process. **(06 Marks)**

Module-3

5 a. Define Solidification. **(02 Marks)**
b. Explain Nucleation process in Solidification of metals. **(06 Marks)**
c. What is Degasification in liquid metals? Explain the methods of Degasification, with neat sketches. **(08 Marks)**

OR

6 a. Explain briefly Sand Casting defects. **(04 Marks)**
b. What are the advantages and limitations of Aluminum castings? **(06 Marks)**
c. Sketch and explain Stir casting setup. **(06 Marks)**

Module-4

7 a. How welding process is classified? **(04 Marks)**
b. Explain with sketch, principle of Flux Shielded Metal Arc Welding. **(06 Marks)**
c. Explain Submerged Arc Welding. **(06 Marks)**

OR

8 a. Explain principle of Resistance Welding. **(04 Marks)**
b. With a neat sketches, explain : i) Spot Welding ii) LASER Welding. **(08 Marks)**
c. Explain Thermit Welding. **(04 Marks)**

Module-5

9	a.	Explain different zones which are formed during welding process.	(08 Marks)
	b.	What are Welding defects? Explain the methods to detect the welding defects.	(08 Marks)

OR

10	a.	Differentiate between Soldering and Brazing.	(04 Marks)
	b.	Explain with a sketch, Principle of Oxy – Acetylene Welding.	(06 Marks)
	c.	Explain the methods used for Inspection of casting and welding.	(06 Marks)

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15MEB306/15ME36B

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Mechanical Measurement and Metrology

Time: 3 hrs. Max. Marks: 80

Note: *Answer FIVE full questions, choosing one full question from each module.*

Module-1

1 a. With neat sketches, explain the material length standards. **(08 Marks)**

b. Mention the methods of measurement with suitable example to each method. **(08 Marks)**

OR

2 a. Using M112 slip gauge set build the following dimensions with minimum number of slip gauges:
(i) 49.3115 (ii) 78.3665 **(08 Marks)**

b. Explain with a neat sketch working principle of sine bar and mention its limitation. **(08 Marks)**

Module-2

3 a. Distinguish between interchangeability and selective assembly. **(06 Marks)**

b. How are plain gauges classified? **(04 Marks)**

c. State and explain Taylor's principle of gauge design. **(06 Marks)**

OR

4 a. Mention the functional requirements of comparators. **(06 Marks)**

b. With a neat sketch, explain the construction and working of Johanson's Mikrokator. **(10 Marks)**

Module-3

5 a. With a neat sketch of a screw thread mention the screw thread parameters and define each one of them. **(08 Marks)**

b. Give the applications of Toolmaker's microscope and with neat sketch show its principal parts. **(08 Marks)**

OR

6 a. Define the following Gear teeth Terminology:
(i) Pitch circle diameter.
(ii) Pressure angle.
(iii) Addendum.
(iv) Dedendum.
(v) Module.
(vi) Diametral pitch.
(vii) Involute.
(viii) Circular pitch. **(08 Marks)**

b. Give the application of CMM and explain the working principle and construction of CMM. **(08 Marks)**

Module-4

7 a. Define the following terms:
   (i) Calibration
   (ii) Repeatability
   (iii) Accuracy
   (iv) Precision
   (v) Reproduceability
   (vi) Linearity
   (vii) System response
   (viii) Sensitivity **(08 Marks)**

   b. Explain any two types of electrical transducers. **(08 Marks)**

OR

8 a. Explain electronic amplifier with a neat sketch. **(08 Marks)**

   b. With a neat sketch, explain the principle and working of stylus type oscillograph. **(08 Marks)**

Module-5

9 a. Explain with a neat sketch unequal arm balance. **(08 Marks)**

   b. With a neat sketch, explain the principle and working of pirani gauge. **(08 Marks)**

OR

10 a. What is a thermo couple? Explain the working principle of a thermocouple with a neat sketch. **(08 Marks)**

   b. Define gauge factor of a strain gauge and explain with a neat sketch measurement of strain using wheat stone bridge circuit. **(08 Marks)**

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10ME32A/AU32A

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Material Science and Metallurgy

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions, selecting atleast TWO questions from each part.*

PART – A

1 a. Define Atomic Packing factor. Derive an expression for atomic packing factor for HCP. (06 Marks)

b. What is Diffusion? Explain. Give the laws governing diffusion with conditions. (08 Marks)

c. Compare twin and tilt boundary defects in metals. Explain how they are useful in manufacturing process. (06 Marks)

2 a. Define i) Resilience ii) Tensile strength iii) Hardness iv) Ductility. (08 Marks)

b. A specimen of 5mm diameter and 25mm gauge length is subjected to tensile test. If its diameter is reduced to 4mm through plastic deformation, what is its length? Also calculate engineering stress, engineering strain , true stress and true strain at the end of the deformation where the load is 500N. (08 Marks)

c. Explain Brinell Hardness Testing. (04 Marks)

3 a. Draw the typical creep curve and explain different stages of creep. (08 Marks)

b. What is fatigue? Explain with S-N curves for the fatigue life of ferrous and non – ferrous materials. (08 Marks)

c. Differentiate between ductile and brittle fracture. (04 Marks)

4 a. Define Solid solution and explain different types of solid solution with figures. (08 Marks)

b. What are Hueme – Rothery's rules? (05 Marks)

c. Explain the construction of phase diagram. (07 Marks)

PART – B

5 a. Draw the Fe – C diagram and label the phases. Show the invariant points on it. Write the reactions occurring at these points indicating the temperature and composition of the reactions. (12 Marks)

b. Draw the TTT diagram for eutectoid steel and explain the effect of cooling rate in forming different microstructure. (08 Marks)

6 a. What is Harden ability? Explain the Joniney End Quench test to find the hardenability. (08 Marks)

b. Explain the following Heat treatments :
i) Annealing ii) Hardening iii) Case Hardening iv) Flame Hardening. (12 Marks)

7 a. Explain different types of Cast Iron with Microstructure. (10 Marks)

b. Explain composition and properties and applications of : (10 Marks)
i) Gun metal ii) Al - Silicon alloy iii) Phosphor bronze iv) Al - Zinc alloy.

8 a. Explain the classification of Composites. (04 Marks)

b. Explain with neat sketches any two types of PMC manufacturing. (08 Marks)

c. Write a note on advantages and disadvantages of composites materials and its applications. (08 Marks)

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10ME/AU34

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Mechanics of Materials

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define : (i) Elasticity (ii) Poisson's ratio (iii) Hooke's law (iv) Principle of superposition. **(04 Marks)**

b. Prove that deformation in a uniform bar due to self weight is equal to half the deformation due to the force equal to its self weight. **(06 Marks)**

c. A stepped bar is subjected to forces as shown in Fig. Q1 (c). Find the maximum value of P that will not exceed a stress in steel of 140 MPa. in aluminium of 90 MPa or in bronze of 100 MPa. **(10 Marks)**

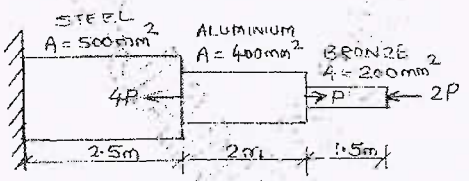

Fig. Q1 (c)

2 a. Define : (i) Volumetric strain (ii) Modulus of rigidity **(02 Marks)**

b. Derive relation $E = 3K(1-2\mu)$ between Young's modulus (E), bulk modulus (K) and Poisson's ratio (μ). **(08 Marks)**

c. A steel tube of 30 mm external diameter and 20 mm internal diameter encloses a copper rod of 15 mm diameter to which it is rigidly joined at each end. If, at a temperature of 10°C there is no longitudinal stress, calculate stresses in rod and tube when the temperature is raised to 200°C. Take E for steel and copper as 2.1×10^5 N/mm^2 and 1×10^5 N/mm^2 respectively. The value of α for steel and copper is given as 11×10^{-6} /° C and 18×10^{-6} /° C respectively. **(10 Marks)**

3 a. Show that sum of the normal stresses on any two planes at right angles in a general two dimensional stress system is constant. **(06 Marks)**

b. Sketch the Mohr's circle for the following cases: **(04 Marks)**

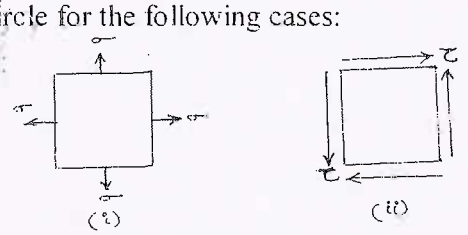

Fig. Q3 (b)

c. A point in a strained material is subjected to the stresses as shown in Fig.Q3 (c). Evaluate principal stresses and locate principal planes. Sketch the planes. **(10 Marks)**

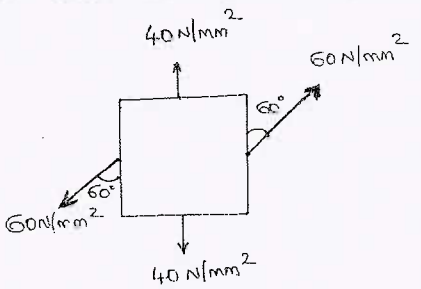

Fig. Q3 (c)

4 a. Derive the expressions for circumferential and radial stresses in the wall of thick cylinder (Lame's equation). **(10 Marks)**

b. The maximum stress produced by a pull in a bar of length 1 m is 150 N/mm^2. The bar details are given in Fig. Q4 (b). Calculate strain energy stored in the bar if E = 200 GPa. **(10 Marks)**

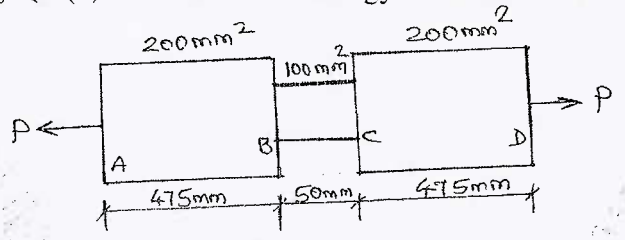

Fig. Q4 (b)

PART – B

5 a. Derive an expression to establish a relationship between the intensity of load W, shear force F and bending moment M in the beam. **(06 Marks)**

b. A beam 8 m long is simply supported at two points and loaded with concentrated loads, two UDL and a couple as shown in Fig. Q5 (b). Draw SF and BM diagrams. **(14 Marks)**

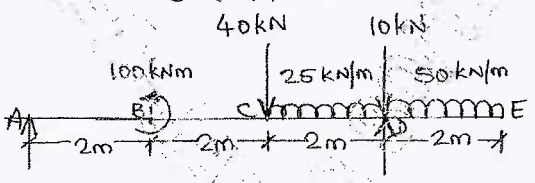

Fig. Q5 (b)

6 a. Prove that the maximum shear stress is 1.5 times the average shear stress in a beam of rectangular cross section. **(06 Marks)**

b. A T-shaped cross section of a beam of flange 200mm × 50mm and web 200mm × 50mm is subjected to a bending moment of 15 kNm and a shear force of 10 kN at a particular section. Draw the bending stress and shear stress distribution diagrams across the section. Indicate values at salient points. **(14 Marks)**

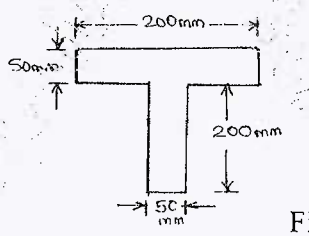

Fig. Q6 (b)

7 a. Derive an expression $EI\frac{d^2y}{dx^2} = M$, with usual notations. **(08 Marks)**

b. A Cantilever of length 3 m and cross section 150 mm width and 300 mm in depth is loaded as shown in Fig. Q7 (b). Take $E = 2.1\times10^5$ N/mm^2. Calculate maximum slope and maximum deflection. **(12 Marks)**

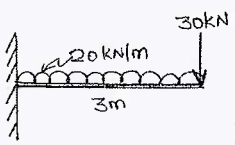

Fig. Q7 (b)

8 a. State at least 4 assumptions made in the Euler's theory of columns, and derive an expression for Euler's formula for a column when both ends are fixed. **(10 Marks)**

b. A hollow shaft of diameter ratio $\frac{3}{5}$ is required to transmit 700 kW at 110 rpm. The maximum torque being 12% greater than the mean. The shearing stress is not exceed 60 MPa and twist in the length of 3 meters not to exceed 1°. Calculate the minimum external diameter. Take $G = 0.8\times10^5$ MPa. **(10 Marks)**

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10ME/AU35

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018
Manufacturing Process – I

Time: 3 hrs. Max. Marks:100

Note: *Answer FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. Explain briefly the different types of manufacturing process and mention their applications. **(08 Marks)**

b. With an illustration explain any two types of patterns. **(08 Marks)**

c. Write a note on binders and additives. **(04 Marks)**

2 a. Explain briefly the characteristics of foundry sand. **(06 Marks)**

b. What is riser? With an illustration, explain different types of risers. **(06 Marks)**

c. With an illustration, explain sand slinger in mould making process. **(08 Marks)**

3 a. With an illustration, explain flaskless moulding process. Mention its advantages. **(10 Marks)**

b. With an illustration, explain continuous casting process and mention its applications. **(10 Marks)**

4 a. With an illustration, explain electrical resistance furnace and mention its limitations. **(08 Marks)**

b. With an illustration, explain construction and operations of CUPOLA furnace. **(12 Marks)**

PART – B

5 a. Define welding. Give a broad classification of welding. **(05 Marks)**

b. With an illustration, explain submerged arc welding process. **(09 Marks)**

c. With an illustration, explain different types of gas flames in gas welding process. **(06 Marks)**

6 a. With an illustrations, explain the following:
(i) Butt welding process.
(ii) Spot welding process. **(12 Marks)**

b. With an illustration, explain the operations of electron beam welding. **(08 Marks)**

7 a. Explain the parameters which effects if on heat affected zone in welding. **(05 Marks)**

b. Write a note on the following:
(i) Welding rods.
(ii) Fluxes in welding. **(06 Marks)**

c. Explain defects, causes and remedies in welding. **(09 Marks)**

8 a. Differentiate between soldering and brazing. **(06 Marks)**

b. Write a note on fluorescent particle method used to detect the defects on component. **(06 Marks)**

c. With an illustration, explain Radiography test used in welding. **(08 Marks)**

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10MEB306/10AUB306

Third Semester B.E. Degree Examination, Dec.2017/Jan.2018

Fluid Mechanics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define the following fluid properties and state their units:
   i) Kinematic viscosity
   ii) Dynamic viscosity
   iii) Surface tension
   iv) Specific gravity
   v) Specific volume **(10 Marks)**

b. A single column U-tube manometer, made of glass tubing having a nominal inside diameter of 2.5 mm, has been used to measure pressure in a pipe or vessel containing air. If the limb opened to atmosphere is 10 percent oversize, find the error in mm of mercury in the measurement of air pressure due to surface tension effects. It is stated that mercury is the manometric fluid for which surface tension $\sigma = 0.514$ N/m and angle of contact $\alpha = 140^\circ$. **(05 Marks)**

c. Calculate the density, specific weight of one litre of petrol of specific gravity = 0.7. **(05 Marks)**

2 a. Differentiate between Absolute and Gauge pressure. **(04 Marks)**

b. Derive an expression for the depth of centre of pressure from free surface of liquid of an inclined plane surface submerged in liquid. **(08 Marks)**

c. A circular opening 3m diameter, in a vertical side of a tank is closed by a disc of 3m diameter which can rotate about a horizontal diameter. Calculate:
   i) The force on the disc and
   ii) The torque required to maintain the disc in equilibrium in the vertical position when the head of water above the horizontal diameter is 4m. **(08 Marks)**

3 a. Explain the terms:
   i) Meta centre
   ii) Meta centric height **(04 Marks)**

b. How will you determine the meta centric height of a floating body experimentally? Explain with neat sketch. **(08 Marks)**

c. A piece of wood (specific gravity = 0.6) of 10 cms square in cross section and 2.5 m long floats in water. How much lead (specific gravity = 12) need to be fastened at the lower end of the stick so that it flows upright with 0.5 m length out of water? **(08 Marks)**

4 a. Derive Bernoulli's equation starting from fundamentals, and state assumptions made. **(10 Marks)**

b. The water is flowing through a taper pipe of length 100 m having diameter 600 mm at the upper end and 300 mm at the lower end, at the rate of 50 liters/second. The pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is 19.62 N/cm^2. **(10 Marks)**

PART – B

5 a. Derive an expression for the discharge through a venturimeter. (10 Marks)

b. A 30 cm × 15 cm venturimeter is provided in a vertical pipeline carrying oil of specific gravity 0.9 the flow being upwards. The difference in elevation of the throat section and entrance section of the venturimeter is 30 cms. The differential U-tube mercury manometer shows a gauge deflection of 25 cms. Calculate:

i) The discharge of oil.

ii) The pressure difference between the entrance section and throat section.

Take the coefficient of meter as 0.98 and specific gravity of mercury as 13.6. (10 Marks)

6 a. Explain the following:

i) Major energy loss

ii) Minor energy loss

iii) Loss of head due to sudden enlargement

iv) Hydraulic gradient line

v) Total energy line (10 Marks)

b. For a town water supply, a main pipe line of diameter 0.4 m is required. As pipes more than 0.35 m diameter are not readily available, two parallel pipes of the same diameter were used for water supply. If the total discharge in the parallel pipes is same as in the single main pipe, find the diameter of the parallel pipe. Assume the coefficient of friction is same for all pipes. (10 Marks)

7 a. Define the terms:

i) Velocity gradient

ii) Pressure gradient. (04 Marks)

b. Derive an expression for the velocity distribution for viscous flow through a circular pipe. Also sketch the velocity distribution and shear stress distribution across a section of the pipe. (08 Marks)

c. A crude oil of viscosity 0.97 poise and relative density 0.9 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. Assume laminar flow. (08 Marks)

8 a. Define the terms drag and lift. (04 Marks)

b. Explain laminar boundary layer and turbulent boundary layer. (08 Marks)

c. Air is flowing over a smooth plate with a velocity of 10 m/s. The length of the plate is 1.2 m and the width 0.8 m. If laminar boundary layer exists up to a value of $R_e = 2 \times 10^5$, find the maximum distance from the leading edge upto which laminar boundary layer exists. Find the maximum thickness of laminar boundary layer if the velocity profile is given $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$. Take kinematic viscosity for air = 0.15 stokes. (08 Marks)

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CBCS Scheme

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15ME42

Fourth Semester B.E. Degree Examination, June/July 2018
Kinematics of Machines

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define the following:
i) Link ii) Kinematic pairs iii) Kinematic chain
iv) Mechanism v) Structure vi) Degree of freedom **(06 Marks)**

b. Explain with neat sketch crank and slotted lever mechanism. **(05 Marks)**

c. Explain with neat sketch peaucellier mechanism. **(05 Marks)**

OR

2 a. Explain with neat sketch Ackerman steering mechanism. Mention condition for correct steering. **(08 Marks)**

b. Explain with neat sketch: i) Oldham's coupling ii) Pantograph. **(08 Marks)**

Module-2

3 The crank and connecting rod of a theoretical steam engine are 0.5 m and 2m long respectively. The crank makes 180 rpm in the clockwise direction. When it has turned 45° from the inner dead centre position, determine:
i) Velocity of piston
ii) Angular velocity of connecting rod
iii) Velocity of point E on the connecting rod 0.5 m from the crank end
iv) Velocities of rubbing at the pins of the crank shaft, crank and cross head when the diameter of their pins are 50 mm, 60 mm and 30 mm respectively
v) Position and linear velocity of any point G on the connecting rod which has the least velocity relative to crank shaft. **(16 Marks)**

OR

4 a. State and prove Aronhold Kennedy's theorem. **(04 Marks)**

b. In a slider crank mechanism, the length of crank and connecting rod are 125 mm and 500 mm respectively. The centre of gravity 'G' of the connecting rod is 275 mm from the slider. The crank speed is 600 rpm clockwise. The crank makes 45° from inner dead centre. Locate all the instantaneous centers and find velocity of slider, velocity of slider, velocity of point G and angular velocity of connecting rod. By Klein's construction, determine the acceleration of the slider and the point G. **(12 Marks)**

Module-3

5 The crank of an engine is 200 mm long and the ratio of connecting rod length to crank radius is 4. Determine the acceleration of piston when the crank has turned through 45° from the inner dead centre position and moving towards center at 240 rpm by complex algebra analysis. **(16 Marks)**

OR

6 a. Derive the expression for Freudenstein's equation for slider crank mechanism. **(12 Marks)**

b. Explain function generation for four bar mechanism. **(04 Marks)**

Module-4

7 a. Derive the equation for length of path of contact. **(08 Marks)**

b. A pair of involute spur gears with 16° pressure angle and pitch of module 6 mm in mesh. The number of teeth on pinion is 16 and its rotational speed is 240 rpm. When the gear ratio is 1.75, find in order that the interference is just avoided:

i) The addenda on pinion and gear wheel

ii) Length of path of contact

iii) The maximum velocity of sliding of teeth on either side of the pitch point. **(08 Marks)**

OR

8 a. Explain with neat sketch:

i) Simple gear train

ii) Compound gear train

iii) Reverted gear train

iv) Epicyclic gear train **(08 Marks)**

b. In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm of the gear train rotates at 150 rpm in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of the gear B. If the gear A instead of using fixed, makes 300 rpm in the clockwise direction, what will be the speed of gear B. Arrangement is shown in Fig.Q8(b).

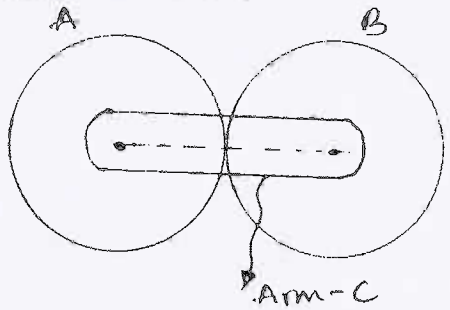

Fig.Q8(b) **(08 Marks)**

Module-5

9 A cam is to be designed for a knife edge follower with the following data, cam lift = 40 mm during 90° for cam rotation with simple harmonic motion, dwell for the next 30°, during the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion, dwell during the remaining 180°. Draw the profile of the cam when the line of stroke of the follower passes through the axis of cam shaft. The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240 rpm. Assume the direction of cam rotation is clockwise. **(16 Marks)**

OR

10 In a symmetrical tangent cam operating a roller follower, the least radius of the cam is 30 mm and roller radius is 17.5 mm. The angle of ascent is 75° and the total lift is 17.5 mm. The speed of the cam shaft is 600 rpm. Calculate:

i) The principal dimensions of the cam.

ii) The accelerations of the follower at the beginning of the lift, where straight flank merges into the circular nose and at the apex of the circular nose. Assume that there is no dwell between ascent and descent. **(16 Marks)**

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CBCS SCHEME

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15ME44

Fourth Semester B.E. Degree Examination, June/July 2018
Fluid Mechanics

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing one full question from each module.***

Module-1

1 a. Define following terms with SI units : i) Mass density ii) Kinematic viscosity iii) Capillarity iv) Compressibility. **(08 Marks)**

b. A circular shaft of diameter 30mm is rotating in a journal bearing of length 20cm. Speed of shaft is 360 rpm. The clearance between shaft and bearing is 0.6mm and dynamic viscosity is 0.2 N-S/m^2. Determine Torque and Power required to rotate the shaft at given speed. **(08 Marks)**

OR

2 a. State and prove Hydrostatic law. **(04 Marks)**

b. Define Meta centre and explain its importance in stability of floating bodies. **(04 Marks)**

c. Determine the total hydrostatic force and its location on a circular plate immersed in a tank containing oil. The circular plate is inclined at 30^0 to free surface of oil and nearest point of it circumference is 1.2m below free surface. Diameter of circular plat is 5m and specific gravity of oil is 0.90. **(08 Marks)**

Module-2

3 a. Derive continuity equation in Cartesian co-ordinates for a fluid flow in 3 – Dimensions. **(06 Marks)**

b. Differentiate between : i) Steady flow and Unsteady flow ii) Viscous flow and Turbulent flow iii) Uniform and Non – Uniform flow. **(06 Marks)**

c. Define and explain stream function and velocity potential function. **(04 Marks)**

OR

4 a. State assumptions in Bernoulli's equation and derive the relation. **(06 Marks)**

b. Differentiate between Venturi meter and Orifice meter. **(04 Marks)**

c. A 30cm × 15cm venturimeter is inserted in a vertical pipeline carrying oil of specific gravity 0.85, the flow of oil is upwards. Throat section is 50cms above inlet section of venturimeter. The oil mercury differential manometer gives a reading of 30cms of mercury. Find the rate of oil flow in lts/sec and pressure difference between inlet and throat section. Assume $C_d = 0.96$. Neglect all losses. **(06 Marks)**

Module-3

5 a. Derive Hagen Poiseuille equation for laminar flow through a circular pipe. **(08 Marks)**

b. Oil of viscosity 10 Poise flows between two parallel plates are kept at a distance of 50mm apart. Find the rate of oil flow between the plates if the pressure drop per meter length is 0.3N/cm^2. Width of plate is 200mm and length of plate is 1.8m. Specific gravity is 0.85. **(08 Marks)**

OR

6 a. Derive Darcy – Weisbach relation for a fluid flow through a pipe. **(08 Marks)**

b. Determine rate of water flow through a pipe of diameter 20cm and length 50m, with one end connected to a tank and other end of pipe is open to the atmosphere. The pipe is horizontal and height of water level in the tank is 7.5m above pipe axis. Consider all losses and assume f = 0.01. Draw HGL. **(08 Marks)**

Module-4

7 a. Explain the term : i) Lift ii) Drag iii) Displacement thickness iv) Momentum thickness. **(08 Marks)**

b. A thin plate is moving in air at a velocity of 5m/s. The length of plate is 0.6m and width 0.5m. Find the thickness of boundary layer at the end of the plate and drag force on one side of the plate. Take density of air as 1.24 kg/m^3 and the kinematic viscosity 0.15 stokes. **(08 Marks)**

OR

8 a. Explain importance of dimensional analysis in the model similitude. Explain Rayleigh method of the dimensional analysis. **(06 Marks)**

b. The frictional torque T of a disc of diameter D depends on speed N, in a fluid of dynamic viscosity μ and density of fluid ρ in a turbulent fluid flow. By Bukingham Pi method, develop a relation for frictional torque T. **(10 Marks)**

Module-5

9 a. Derive an expression for velocity of sound in a fluid. **(08 Marks)**

b. An Aeroplane is flying at an height of 15km where the temperature is -50^{0}C. The speed of the plan is corresponding to Mach number 2.0. Assume K = 1.4 , R = 287 J/kg ^{0}K. Find the speed of the plane. **(08 Marks)**

OR

10 a. Define the following terms : i) Mach number ii) Mach cone iii) Zone of action iv) Subsonic flow v) Supersonic flow. **(10 Marks)**

b. Explain the meaning o CFD and its applications. **(06 Marks)**

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CBCS Scheme

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15ME43

Fourth Semester B.E. Degree Examination, June/July 2018
Applied Thermodynamics

Time: 3 hrs. Max. Marks: 80

Note: **1.** ***Answer any FIVE full questions, choosing one full question from each module.***
2. ***Use of thermodynamics data handbook is permitted.***

Module-1

1 a. Derive an expression for mean effective pressure in an air standard Otto cycle. **(08 Marks)**

b. Compression ratio of an air standard dual cycle is 8. Air is at 100 kPa, 300 K at the beginning of the compression process. The temperature of air at the end of constant pressure heat addition process is 1300 K. The net heat transfer to the cycle is 480 kJ/kg. Determine:
i) Heat added during constant volume per kg of air
ii) Air standard cycle efficiency and
iii) m.e.p. **(08 Marks)**

OR

2 a. For a simple gas turbine cycle, the optimum pressure ratio for maximum work output of cycle is given by

$$r_p = \left\{ \eta_C \eta_T \frac{T_3}{T_1} \right\}^{\frac{\gamma}{2(\gamma-1)}}$$

where η_C and η_T are the isentropic efficiency of compressor and turbine respectively, T_3 and T_1 = maximum and minimum temperature of the cycle respectively. $\gamma = C_p/C_v$ **(08 Marks)**

b. Determine the network output and thermal efficiency of an ideal gas turbine cycle having two stages of compression with perfect intercooling, two stages of expansion with perfect reheating between the stages and an ideal regenerator. The overall pressure ratio of the cycle is 4 and the maximum temperature of the cycle is 900°C. Assume that the atmospheric temperature is 15°C and the cycle is designed for maximum work output. Draw the schematic and T-S diagrams for the cycle. **(08 Marks)**

Module-2

3 a. Why is Carnot cycle not practicable for steam power plant? Explain briefly with the help of T-S diagram. **(06 Marks)**

b. Discuss the effect of (i) Boiler pressure and (ii) Superheat on the performance of a Rankine cycle. **(06 Marks)**

c. A steam power plant operates on a theoretical reheat cycle. Steam at boiler with 150 bar, 550°C expands through the high pressure turbine. It is reheated at a constant pressure of 40 bar to 550°C and expands through the low pressure turbine to a condenser at 0.1 bar. Draw h-s diagram and find:
i) Quality of steam at turbine exit
ii) Cycle efficiency
iii) Steam rate in kg/KW.h **(04 Marks)**

OR

4 a. With the help of flow and h-s diagram, derive an expression for cycle efficiency and also for mass of steam bled in a practical regenerative steam cycle with one open feed water heater. **(08 Marks)**

b. Steam at 30 bar, 350°C is supplied to a steam turbine in a practical regenerative cycle and the steam is bled at 4 bar. The bled steam comes out as dry saturated steam and heats the feed water in an direct contact type feed water heater to its saturated liquid state. The rest of the steam in the turbine expands to condenser pressure of 0.1 bar. Assuming the turbine efficiency to be same before and after bleeding; determine:
i) The turbine efficiency
ii) Steam quality at the condenser inlet
iii) Mass of steam bled per kg of boiler steam
iv) Cycle efficiency. **(08 Marks)**

Module-3

5 a. With neat sketch, explain the Orsat's apparatus used for exhaust gas analysis. **(06 Marks)**

b. The products of combustion of an unknown hydrocarbon C_xH_y have the following composition as measured by an Orsat apparatus: CO_2 = 8.0%, CO = 0.9%, O_2 = 8.8% and rest is N_2. Determine:
i) Composition of the fuel
ii) The air-fuel ratio
iii) Percentage of excess air
iv) Dew point temperature of the products if the total pressure is 1.0 bar. **(10 Marks)**

OR

6 a. Explain the principle of conducting Morse test on IC engines for determining frictional power. **(04 Marks)**

b. List the factors affecting the detonation. **(02 Marks)**

c. A 4-cylinder 2-stroke petrol engine has a bore of 57 mm and stroke of 90 mm. Its rated speed is 2800 rpm and is tested at this speed against a brake, which has a torque arm of 0.356 m. The net brake load is 155 N and the fuel consumption is 6.74 lit/h. The specific gravity of the petrol is 0.735 and it has a calorific value of 44200 kJ/kg. A Morse test is carried out and the cylinders are cut-out in order 1, 2, 3, 4 with corresponding brake loads 111, 106.5, 104.2 and 111.3 N respectively. Calculate for this speed :
i) The engine torque ii) Brake mean effective pressure
iii) Brake thermal efficiency iv) BSFC
v) Mechanical efficiency vi) Indicated thermal efficiency. **(10 Marks)**

Module-4

7 a. A vapour compression plant uses R-12 and is to develop 5 tonnes of refrigeration. The condenser and evaporator temperatures are to be 40°C and −10°C respectively. Determine:
i) The refrigerant flow rate in kg/s
ii) Heat rejected in the condenser in KW
iii) COP
iv) Power required to drive the compressor **(06 Marks)**

b. An air refrigeration system working on Reversed Brayton Cycle with 15 tonnes capacity has its pressure range 1 bar to 10 bar. Air enters the compressor at −5°C and enters the expander at 25°C. Assuming the isentropic efficiency of expander and compressor each has 85%, find: i) COP ii) Air flow rate and iii) Power required. **(06 Marks)**

c. What are the desirable properties of good refrigerant? **(04 Marks)**

OR

8 a. With a neat sketch explain the working of air conditioning system for hot and dry summer condition. Show the processes on psychrometric chart. **(08 Marks)**

b. It is required to design an air conditioning plant for a office room with the following conditions:
Outdoor conditions: 14°C DBT and 10°C WBT
Required conditions: 20°C DBT and 60% RH
Amount of air circulation = 0.3 m^3/min/person
Seating capacity of office = 60
The required condition is achieved first by heating and then by adiabatic humidifying. Determine:
i) Heating capacity of the coil in KW and surface temperature required if the by-pass factor of the coil is 0.4.
ii) The capacity of the humidifier. **(08 Marks)**

Module-5

9 a. Derive the condition for minimum work required by a two stage air compressor with perfect intercooling between stages. Assume the compression follows the law $PV^n = C$ for stage-1 and for the stage-2 follows $PV^m = C$. Reduce this equation when n = m. **(08 Marks)**

b. A single stage, double acting air compressor, required to deliver 14 m^3 of air per minute measured at 1.013 bar and 15°C. The delivery pressure is 7 bar and speed is 300 rpm. Take the clearance volume as 5% of swept volume with the compression and expansion index, n = 1.3. Calculate:
i) the bore and stroke of the cylinder assuming L = 1.2 D
ii) Delivery temperature
iii) Indicated power required. **(08 Marks)**

OR

10 a. Prove that maximum flow rate of steam per unit area through a nozzle occurs when the ratio of pressure at throat to the inlet pressure is equal to $\left(\frac{2}{n+1}\right)^{\frac{n}{n-1}}$ where n = isentropic index of expansion. **(08 Marks)**

b. An adiabatic steam nozzle is to be designed for a discharge rate of 10 kg/s of steam from 10 bar and 400°C to a back pressure of 1 bar. The nozzle efficiency is 0.92 and the frictional loss is assumed to take place in the diverging portion of the nozzle only. Calculate: i) Velocity of steam at throat and exit of the nozzle, ii) Throat and exit area. Assume index of expansion = 1.3. **(08 Marks)**

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CBCS SCHEME

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15MEB405/15MA45

Fourth Semester B.E. Degree Examination, June/July 2018
Machine Tools and Operations

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define Machine tool. Give the classification of machine tools. **(08 Marks)**

b. Explain the constructional features of horizontal milling machine with a neat sketch. **(08 Marks)**

OR

2 a. Define drilling. With a neat sketch explain bench drilling machine. **(08 Marks)**

b. Define grinding. Compare cylindrical grinding and center less grinding. **(08 Marks)**

Module-2

3 a. Explain the following operations with simple sketches:
i) Turning
ii) Counter sinking
iii) Knurling
iv) Reaming. **(08 Marks)**

b. What are the different motions provided on:
i) Drilling machine
ii) Planer
iii) Grinding machine
iv) Shaping machine. **(08 Marks)**

OR

4 a. With a neat sketch, explain thread cutting operation on lathe. **(08 Marks)**

b. List and explain different machining parameters and related quantities on a lathe. **(08 Marks)**

Module-3

5 a. Briefly explain the desirable properties of cutting fluids. **(08 Marks)**

b. Calculate machining time for a work piece of 90mm diameter and 130mm length turned in 2 passes. If the approach length is 12mm and over travel is 5mm. Given cutting speed = 30m/min and feed 0.3 mm/rev. **(08 Marks)**

OR

6 a. Briefly explain desirable properties or characteristics of an ideal cutting tool material. List various cutting tool materials. **(08 Marks)**

b. A shaping machine is used to machine a rectangular piece of 18cm long and 35cm width, with cutting speed being 26 m/min. Feed is 0.8 mm/cycle. Time for cutting to return stroke is 3:2. Find the time required to machine the whole surface. **(08 Marks)**

Module-4

7 a. Explain the different types of chips produced during metal cutting with neat sketches. **(08 Marks)**

b. With neat sketches explain the difference between orthogonal cutting and oblique cutting. **(08 Marks)**

OR

8 a. What are the components of cutting force in turning a cylindrical job? **(08 Marks)**

b. It is required to drill a 20mm diameter hole in a mild steel plate at a feed rate of 0.25 mm/rev and at a drill speed of 300rpm. Estimate the power required. Take machining constant C = 0.36 for mild steel material. **(08 Marks)**

Module-5

9 a. List the factors affecting tool life and briefly explain them. **(08 Marks)**

b. A tool life of 80 minutes is obtained at a speed of 30mpm and 8 minutes at 60mpm. Determine the following:

i) Tool life equation

ii) Cutting speed for 4 minute tool life. **(08 Marks)**

OR

10 a. Define tool wear. Explain crater wear and flank wear. **(08 Marks)**

b. What is machinability? List out the machinability criteria and explain them briefly. **(08 Marks)**

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CBCS SCHEME

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15MEA405

Fourth Semester B.E. Degree Examination, June/July 2018
Metal Casting and Welding

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Briefly explain the steps involved in manufacturing of product by casting process. **(08 Marks)**

b. What is pattern? Explain different pattern allowances. **(08 Marks)**

OR

2 a. With a neat sketch explain the working principle of "Sand Slinger". **(08 Marks)**

b. Explain with neat sketch carbon dioxide (CO_2) moulding process. **(08 Marks)**

Module-2

3 a. How do you classify the melting furnace? Draw a neat sketch and explain the working of gas fired pit furnace. **(08 Marks)**

b. What are the zones in "CUPOLA"? With neat sketch explain Cupola furnace. **(08 Marks)**

OR

4 a. With neat sketch, explain continuous casting process. **(08 Marks)**

b. With neat sketch, explain Hot chamber pressure die casting process. **(08 Marks)**

Module-3

5 a. What is nucleation? Explain type of nucleation with neat sketch. **(08 Marks)**

b. What is degasification in liquid metals? Explain with neat sketch flushing degasification method. **(08 Marks)**

OR

6 a. With neat sketch, explain Stri casting set-up. **(08 Marks)**

b. What is fettling? What are the steps involved in fettling? Explain briefly sans casting defects. **(08 Marks)**

Module-4

7 a. Sketch and explain "MIG" [Metal Inert Gas welding] welding process. Mention its advantages and disadvantages. **(08 Marks)**

b. Explain with a neat sketch, "SAW" [Submerged Arc Welding] process. **(08 Marks)**

OR

8 a. Explain with neat sketch:
(i) Seam welding process (ii) Explosive welding process. **(08 Marks)**

b. Explain with neat sketch, "LASER" beam welding and mention its advantages and disadvantages. **(08 Marks)**

Module-5

9 a. What is heat affected zone (HAZ)? Explain the parameters affecting HAZ. **(08 Marks)**

b. Explain with neat sketch, Oxy-Acetylene welding process. **(08 Marks)**

OR

10 a. Differentiate between Soldering and Brazing. Mention their advantages and disadvantages. **(08 Marks)**

b. With neat sketch and explain Ultrasonic inspection of casting process. **(08 Marks)**

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10ME/AU43

Fourth Semester B.E. Degree Examination, June/July 2018
Applied Thermodynamics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define the following:
i) Higher and lower calorific values ii) Combustion efficiency
iii) Dew point temperature iv) Adiabatic flame temperature
v) Percent excess air **(10 Marks)**

b. One kg of ethane (C_2H_6) is burnt with 90% of theoretical air. Assuming complete combustion of hydrogen in the fuel determine the volumetric analysis of the dry products of combustion. **(10 Marks)**

2 a. What is air-standard cycle? State the assumptions made in the analysis of air standard cycle. **(05 Marks)**

b. Show that if an Otto cycle works between the temperature limits T_3 and T_1, the compression ratio for maximum workdone/cycle/kg is expressed as, $r_v = \left[\frac{T_3}{T_1}\right]^{\frac{1}{2(\gamma-1)}}$ where r_v is compression ratio. **(05 Marks)**

c. An engine operating on the ideal diesel cycle has a compression ratio 16:1. Heat is added during constant pressure process upto 8% of the stroke. If the engine inhales 0.04 m^3/s at 101 kPa and 25°C, determine:
i) The maximum pressure and temperature in the cycle.
ii) The thermal efficiency of the engine.
iii) The power developed. **(10 Marks)**

3 a. Derive an expression for indicated power of multi cylinder IC engine for Morse test. **(04 Marks)**

b. Define: i) Mean effective pressure
ii) Specific fuel consumption
iii) Volumetric efficiency **(06 Marks)**

c. A four cylinder 4-stroke petrol engine has a bore of 60 mm and a stroke of 90 mm. Its rated speed is 2800 rpm and it is tested at this speed against brake which has a torque arm of 0.37 m. The net brake load is 160 N and the fuel consumption is 8.966 litres/hr. The specific gravity of petrol used is 0.74 and it has a lower calorific value of 44100 kJ/kg. A Morse test is carried out and the cylinders are cut out in the order 1, 2, 3, 4 with corresponding brake loads of 110, 107, 104 and 110 N respectively. Calculate for this speed:
i) Brake power ii) Brake mean effective pressure
iii) Brake thermal efficiency iv) Mechanical efficiency **(10 Marks)**

4 a. Explain the effect of variation of pressure and super heat on Rankine cycle efficiency with the help of a T-S diagram. **(10 Marks)**

b. 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 dryness at the end of expansion.
Assume flow rate of steam is 9.5 kg/s. **(10 Marks)**

PART – B

5 a. Explain the condition for minimum work for a reciprocating compressor and also define isothermal efficiency based on the indicator diagram. **(05 Marks)**

b. Derive an expression for the volumetric efficiency of reciprocating air compressor. **(05 Marks)**

c. A single stage single acting air compressor delivers 0.6 kg of air per minute at 6 bar. The temperature and pressure at the end of suction stroke are 30°C and 1 bar. The bore and stroke of the compressor are 100 mm and 150 mm respectively. The clearance is 3% of the swept volume. Assuming the index of compression and expansion to be 1.3, find:

i) Volumetric efficiency of the compressor
ii) Power required if the mechanical efficiency is 85% and
iii) Speed of the compressor (rpm). **(10 Marks)**

6 a. What is the role of combustion chamber in gas turbine plant? Explain how the actual gas turbine cycle differs from the theoretical cycle. **(06 Marks)**

b. Draw the flow diagram and h-s diagram for open cycle gas turbine with perfect intercooling. **(04 Marks)**

c. In a constant pressure open cycle gas turbine air enters at 1 bar and 20°C and leaves the compressor at 5 bar. The maximum cycle temperature is 680°C, pressure loss in the combustion chamber is 0.1 bar. Isentropic efficiencies of compressor and turbine are 85% and 80% respectively, $\gamma = 1.4$ and $C_p = 1.024$ kJ/kgK for air and gas. Find:

i) The quantity of air circulation if the plant develops 1065 KW.
ii) Heat supplied per kg of air.
iii) The thermal efficiency of the cycle. **(10 Marks)**

7 a. Derive an expression for COP for an air refrigeration system working on reversed Carnot cycle. **(10 Marks)**

b. A refrigeration system of 10.5 tonnes capacity at an evaporator temperature of –12°C and a condenser temperature of 27°C is needed in a food storage locker. The refrigerant ammonia is subcooled by 6°C before entering the expansion valve. The vapour is 0.95 dry as if leaves the evaporator coil. The compression in the compressor is of adiabatic type. Using p-h chart find:

i) Condition of volume at outlet of the compressor.
ii) Condition of vapour at entrance to evaporator
iii) C.O.P
iv) Power required in KW

Neglect valve throttling and clearance effect. **(10 Marks)**

8 a. With a neat sketch describe the working of summer air conditioning system for hot and dry weather. **(07 Marks)**

b. Define:

i) Dry bulb temperature
ii) Wet bulb temperature
iii) Relative humidity. **(03 Marks)**

c. Air at 20°C, 40% RH is mixed adiabatically with air at 40°C, 40% RH in the ratio of 1 kg of the former with 2 kg of the latter (on dry basis). Find the final condition of air. **(10 Marks)**

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10ME/AU44

Fourth Semester B.E. Degree Examination, June/July 2018
Kinematics of Machines

Time: 3 hrs. Max. Marks:100

Note: *Answer FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. Define the following with an example each:
(i) Flexible link. (ii) Higher pair. (iii) Spherical pair.
(iv) Successfully constrained motion. (v) Unclosed pair. **(05 Marks)**

b. Determine the mobility of the system shown in Fig. Q2 (b). **(05 Marks)**

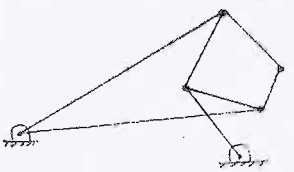

Fig. Q2 (b)

c. With neat sketch, explain (i) Oldham's coupling. (ii) Rotary engine. **(10 Marks)**

2 With neat sketch, explain (i) Quick return motion mechanism. (ii) Straight line mechanism (exact). (iii) Intermittent motion mechanism. **(20 Marks)**

3 In the mechanism shown in Fig. Q3 line OA = 320 mm, AC = 680 mm and OQ = 650 mm. Determine (i) the angular velocity of the cylinder. (ii) the sliding velocity of the plunger. (iii) the absolute velocity of the plunger. when the crank QA rotates at 20 rad/sec CW. **(20 Marks)**

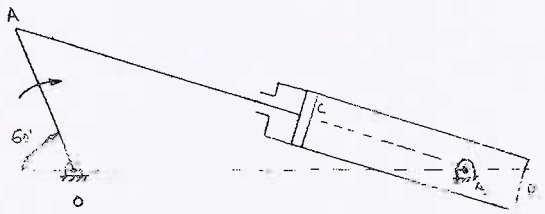

Fig. Q3

4 In the toggle mechanism shown in Fig. Q4, the slider D is constrained to move in a horizontal path. The crank OA is rotating in CCW direction at a speed of 180 rpm. The dimensions of the various links are as follows: OA=180 mm, CB=240 mm, AB=360 mm, BD=540 mm. Find:(i) Velocity of slider. (ii) Angular velocity of links AB, CB, BD using instantaneous centre method. **(20 Marks)**

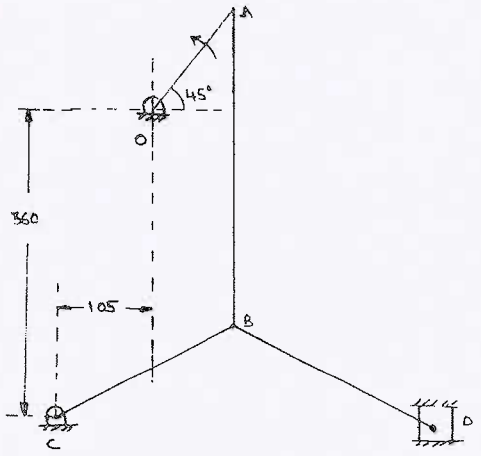

Fig. Q4

PART – B

5 In the 4-bar mechanism shown in Fig. Q5, link AB rotates uniformly at 2 rad/sec in CW sense. Using complex algebra write loop closure equation for this. Determine magnitude and directions of angular velocity and angular acceleration of links BC and CD using vector algebra. Also, state whether the magnitudes of angular velocity of these links tend to increase or decrease at the instant. **(20 Marks)**

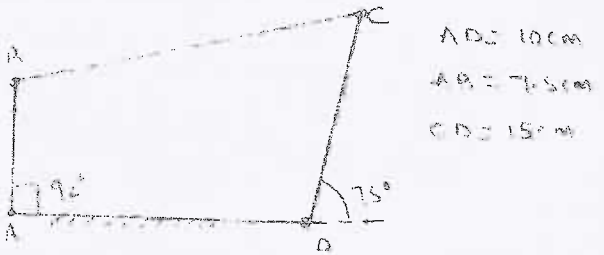

Fig. Q5

6 a. Compare involute and cycloidal tooth profile of a gear with respect to, (i) Pressure angle (ii) Interface. **(04 Marks)**

b. A standard full depth $14\frac{1}{2}$ gear have a module of 5 mm, pinion has 15 teeth while the wheel has 60 teeth knowing the addendum = 1 module,

(i) Show that the gear will interfere with the pinion.

(ii) What should be the pressure angle to avoid interference, if all other details remain same? **(16 Marks)**

7 Two shafts A and B are co-axial. A gear C (50 teeth) is rigidly mounted on shaft 'A'. A compound gear D-E gears with 'C' and an internal gear 'G', D has 20 teeth and gears with 'C' and 'E' has 35 teeth and gears with an internal gear 'G'. Gear 'G' is fixed and is concentric with the shaft axis. The compound gear D.E is mounted on a pin which projects from an arm keyed to the shaft 'B'.

(i) Sketch the arrangement.

(ii) Find the number of teeth on the internal gear G assuming that all gears have the same module.

(iii) If the shaft A rotates at 110 rpm, find the speed of shaft B. **(20 Marks)**

8 For a cam follower system shown in Fig. Q8, draw the displacement diagram for the follower and cam profile. Motion of the follower is as follows. Rise through 20° in 90° cam rotation in SHM, dwell in 90° cam rotation, fall in 90° cam rotation in SHM. The cam rotates in CW direction. **(20 Marks)**

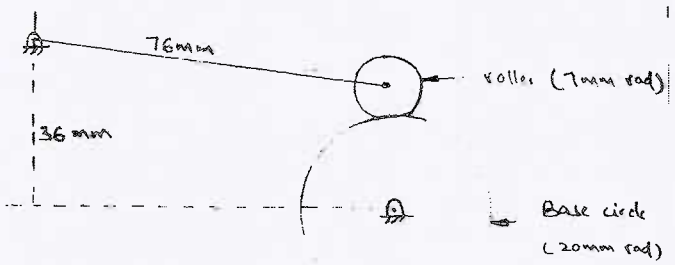

Fig. Q8

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