CBCS SCHEME

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

15MAT31

Third Semester B.E. Degree Examination, June/July 2019
Engineering Mathematics – III

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Obtain the Fourier series for the function :

$$f(x) = \begin{cases} -\pi & \text{in } -\pi < x < 0 \\ x & \text{in } 0 < x < \pi \end{cases}$$

Hence deduce that $\sum_{n=1}^{\infty} \frac{1}{(2n-1)^2} = \frac{\pi^2}{8}$. **(08 Marks)**

b. Express y as a Fourier series up to the second harmonics, given :

x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	2π
y	1.98	1.30	1.05	1.30	–0.88	–0.25	1.98

(08 Marks)

OR

2 a. Obtain the Fourier series for the function $f(x) = 2x - x^2$ in $0 \le x \le 2$. **(08 Marks)**

b. Obtain the constant term and the first two coefficients in the only Fourier cosine series for given data :

x	0	1	2	3	4	5
y	4	8	15	7	6	2

(08 Marks)

Module-2

3 a. Find the Fourier transform of $xe^{-|x|}$. **(06 Marks)**

b. Find the Fourier sine transform of $\frac{e^{-ax}}{x}$, $a > 0$. **(05 Marks)**

c. Obtain the z – transform of $\sin n\theta$ and $\cos n\theta$. **(05 Marks)**

OR

4 a. Find the inverse cosine transform of $F(\alpha) = \begin{cases} 1-\alpha, & 0 \le \alpha \le 1 \\ 0, & \alpha > 1 \end{cases}$.

Hence evaluate $\int_0^{\infty} \frac{\sin^2 t}{t^2} dt$. **(06 Marks)**

b. Find inverse Z – transform of $\frac{3z^2 + 2z}{(5z-1)(5z+2)}$ **(05 Marks)**

c. Solve the difference equation $y_{n+2} + 6y_{n+1} + 9yl = 2^n$ with $y_0 = 0, y_1 = 0$, using z – transforms. **(05 Marks)**

Module-3

5 a. Find the lines of regression and the coefficient of correlation for the data :

x	1	2	3	4	5	6	7
y	9	8	10	12	11	13	14

(06 Marks)

b. Fit a second degree polynomial to the data :

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

(05 Marks)

c. Find the real root of the equation $x \sin x + \cos x = 0$ near $x = \pi$, by using Newton – Raphson method upto four decimal places. **(05 Marks)**

OR

6 a. In a partially destroyed laboratory record, only the lines of regression of y on x and x on y are available as $4x - 5y + 33 = 0$ and $20x - 9y = 107$ respectively. Calculate $\bar{x}, \bar{y}$ and the coefficient of correlation between x and y. **(06 Marks)**

b. Fit a curve of the type $y = ae^{bx}$ to the data :

x	5	15	20	30	35	40
y	10	14	25	40	50	62

(05 Marks)

c. Solve $\cos x = 3x - 1$ by using Regula – Falsi method correct upto three decimal places, (Carryout two approximations). **(05 Marks)**

Module-4

7 a. Give f(40) = 184, f(50) = 204, f(60) = 226, f(70) = 250, f(80) = 276, f(90) = 304. Find f(38) using Newton's forward interpolation formula. **(06 Marks)**

b. Find the interpolating polynomial for the data :

x	0	1	2	5
y	2	3	12	147

By using Lagrange's interpolating formula. **(05 Marks)**

c. Use Simpson's $\frac{3}{8}$th rule to evaluate $\int_0^{0.3} (1-8x^3)^{1/2} dx$ considering 3 equal intervals.

(05 Marks)

OR

8 a. The area of a circle (A) corresponding to diameter (D) is given below :

D	80	85	90	95	100
A	5026	5674	6362	7088	7854

Find the area corresponding to diameter 105, using an appropriate interpolation formula. **(06 Marks)**

b. Given the values :

x	5	7	11	13	17
f(x)	150	392	1452	2366	5202

Evaluate f(9) using Newton's divided difference formula. **(05 Marks)**

c. Evaluate $\int_0^1 \frac{x}{1+x^2} dx$ by Weddle's rule taking seven ordinates. **(05 Marks)**

Module-5

9 a. Using Green's theorem, evaluate $\int_C (2x^2 - y^2)dx + (x^2 + y^2)dy$ where C is the triangle formed by the lines x = 0, y = 0 and x + y = 1. **(06 Marks)**

b. Verify Stoke's theorem for $\vec{f} = (2x - y)i - yz^2j - y^2zk$ for the upper half of the sphere $x^2 + y^2 + z^2 = 1$. **(05 Marks)**

c. Find the extermal of the functional $\int_{x_1}^{x_2} \{y^2 + (y^1)^2 + 2ye^x\}dx$. **(05 Marks)**

OR

10 a. Using Gauss divergence theorem, evaluate $\int_S \vec{f} \cdot \hat{n}\, ds$, where $\vec{f} = 4xzi - y^2j + yzk$ and s is the surface of the cube bounded by x = 0, x = 1, y = 0, y = 1, z = 0, z = 1. **(05 Marks)**

b. A heavy cable hangs freely under the gravity between two fixed points. Show that the shape of the cable is a Catenary. **(06 Marks)**

c. Find the extermal of the functional $\int_0^{\pi/2} \{(y^1)^2 - y^2 + 4y\cos x\}dx$, give that y = 0 = y(π/2). **(05 Marks)**

* * * * *

CBCS SCHEME

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

15ME/MA32

Third Semester B.E. Degree Examination, June/July 2019
Material Science

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Show that the atomic packing factor for HCP is 0.74. **(05 Marks)**

b. Define the following : i) Diffusion flux ii) Fracture toughness iii) Proof stress iv) Strain hardening. **(04 Marks)**

c. A steel tank in a process industry contains nitrogen at 400^0K and at a constant pressure of 15 atm. Vacuum exists outside the tank. Nitrogen concentration at the inner surface of the tank is equal to 12 kg/m^3. The constant $D_0 = 5 \times 10^{-7}$ m^2/s and activation energy for diffusion process between nitrogen and steel is 75 kJ/mol. Calculate the rate at which nitrogen escapes through the tank wall. The thickness of tank wall is 6mm. **(07 Marks)**

OR

2 a. A cylindrical specimen of steel having an original diameter of 12.8mm is tensile tested to fracture and found to have an engineering fracture strength a_f of 460 MPa. If the cross sectional diameter at fracture is 10.7mm determine i) the ductility in terms of percent reduction in area ii) the true stress at fracture. **(04 Marks)**

b. Explain the mechanisms of strengthening in metals. **(06 Marks)**

c. Explain the following : i) Twin boundaries ii) S-N diagram iii) Three stages of creep. **(06 Marks)**

Module-2

3 a. Explain Hume Rothery conditions for unlimited solid solubility. **(04 Marks)**

b. Explain the mechanism of solidification. **(06 Marks)**

c. Calculate the amounts of α , L at 1250^0C in the C_u – 40% Ni alloy shown in fig. Q3(c). **(06 Marks)**

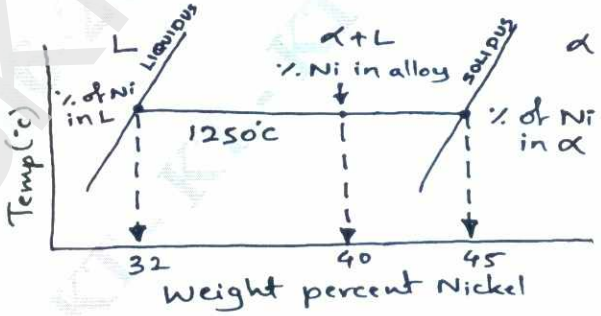

Fig.Q3(c)

OR

4 a. Explain Eutectic system with a neat sketch in a Binary phase diagram. **(08 Marks)**

b. Distinguish between substitutional and interstitial solid solution, with a neat sketch. **(08 Marks)**

Module-3

5 a. Draw Iron – Carbon equilibrium diagram upto 6.67% carbon. **(08 Marks)**

b. Explain Annealing, with neat sketch. **(05 Marks)**

c. List the purpose of normalizing. **(03 Marks)**

OR

6 a. Explain Age hardening of Aℓ - Cu alloys, with neat sketch. **(08 Marks)**

b. List the properties and composition of SG Iron and Steel. **(08 Marks)**

Module-4

7 a. Explain functional and structural classification of ceramic materials. **(05 Marks)**

b. Explain Electrical and thermal properties of ceramic materials. **(05 Marks)**

c. Write short notes on the following :

i) Biocompatible materials

ii) Direct and converse effect in piezoelectric material. **(06 Marks)**

OR

8 a. What is Smart material? Why piezoelectric material and SMA material are termed as Smart materials. **(04 Marks)**

b. Explain briefly the following : i) Super elasticity ii) Mechanical behaviour of plastics iii) Fiber optics materials. **(06 Marks)**

c. Differentiate between Thermosetting and Thermoplastic materials. **(06 Marks)**

Module-5

9 a. Are composite materials isotropic and / or homogeneous? Explain. **(04 Marks)**

b. Evaluate expression for longitudinal Young's modulus of unidirectional lamina using strength of materials approach. **(06 Marks)**

c. Explain the merits and demerits of MMC's. **(06 Marks)**

OR

10 a. Explain the classification of composite materials. **(06 Marks)**

b. What is Hybrid composite? Explain the types of hybrid laminates. **(04 Marks)**

c. Explain the applications of the following :

i) Ceramic metal composites.

ii) Metal matrix composites.

iii) Polymer matrix composites. **(06 Marks)**

* * * * *

CBCS SCHEME

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

15ME33

Third Semester B.E. Degree Examination, June/July 2019
Basic Thermodynamics

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of Thermodynamic data hand book and steam table is permitted.

Module-1

1 a. Distinguish between macro and microscopic point of view of thermodynamics. **(05 Marks)**

b. Classify the following into intensive and extensive properties.
i) Molecular weight ii) Enthalpy iii) Refractive index
iv) Quality of steam v) Entropy vi) Roll strength of class. **(03 Marks)**

c. Develop a linear scale '°B' where in ice and normal body temperature are assumed as two fixed points and assigned the values 0°B and 50°B respectively. If temperature of human body on Celsius scale is 36.7°C, obtain the relation between '°B' scale and °C' scale and find out boiling temperature of water in 'B' scale. **(08 Marks)**

OR

2 a. With a suitable example define work from thermodynamic point of view. **(04 Marks)**

b. Prove that heat transfer is a path function. **(04 Marks)**

c. The properties of a closed system changes following the relation between pressure and volume as PV = 3.0, where P is in bar, V is in m^3. Calculate the work transfer, when the pressure increases from 1.5 bar to 7.5 bar. **(08 Marks)**

Module-2

3 a. Using first law of thermodynamics for non-flow system, show that the heat transfer is equal to the enthalpy change of a system during constant pressure process. **(04 Marks)**

b. A housewife on a warm summer day, decided to beat heat by closing the windows and doors in the kitchen and opening the refrigerator door. At first she feels cool and refreshed, but after a while the effect begins to wear off. Evaluate the situation as if relates to 'first law of thermodynamics' considering room including the refrigerators the system. **(04 Marks)**

c. A centrifugal pump delivers 50kg of water per second. The inlet and outlet pressure are 1 bar ad 4.2 bar respectively. The suction is 2.2m below the centre of the pump and delivery is 8.5 above the centre of the pump. The section and delivery pipe diameters are 20cm and 30cm respectively. Determine the capacity of the electric motor to run the pump. **(08 Marks)**

OR

4 a. Define the following :
i) Thermal Energy Reservoir (TER).
ii) COP of Heat pump. **(04 Marks)**

b. What is PMM – 2? Why it is impossible? **(04 Marks)**

c. A fish freezing plant requires 40 tons of refrigeration. The freezing temperature is -35°C, while the ambient temperature is 30°C. if the performance of the plant is 20% of the theoretical reversed Carnot cycle working within the some temperature limits, calculate power required. **(08 Marks)**

Module-3

5 a. Explain the conditions for reversibility. **(03 Marks)**

b. Show that heat transfer through a finite temperature difference is irreversible. **(05 Marks)**

c. Show that the efficiencies of all reversible heat engines operating between the same temperature levels is the same. **(08 Marks)**

OR

6 a. Show that entropy is a property of system. **(05 Marks)**

b. Explain the 'principle of entropy'. **(03 Marks)**

c. 1 kg of ice at -5°C is exposed to the atmosphere, which is at 25°C. The ice melts and comes into thermal equilibrium. Determine the entropy increase of the universe. Take C_p of ice = 2.093kJ/kg°C. Letent heat of fusion of Ice = 333.33 kJ/kg. **(08 Marks)**

Module-4

7 a. What do you understand by the 'thermodynamic dead state? Explain briefly. **(04 Marks)**

b. Prove that, $\eta_{II} = \frac{\eta_I}{\eta_{Carnot}}$. **(04 Marks)**

c. Derive the Maxwell relations and explain their importance in thermodynamics. **(08 Marks)**

OR

8 a. Define the following terms with reference to pure substance.

i) Saturation temperature
ii) Latent heat of vaporization
iii) Critical point
iv) Tripple point **(02 Marks)**

b. With neat sketch, explain the measurement of dryness fraction of steam by using 'Throttling Calorimeter". **(06 Marks)**

c. Two boilers one with superheater and other without superheater are delivering equal quantities of steam into common main. The pressure in the boilers and main is 20bar. The temperature of steam from a boiler with a superheater is 350°C and temperature of the steam in the main is 250°C. Determine the quality of steam supplied by the other boiler. Take C_{Ps} = 2.5kJ/kgk. **(08 Marks)**

Module-5

9 a. Show that for an ideal gas, $C_p - C_v = R$. **(06 Marks)**

b. A mass of air is initially at 260°C and 700KPa, and occupies 0.028m^3. The air is expanded at constant pressure to 0.084m^3. A polytropic process with n = 1.5 is then carried out, followed by a constant temperature process which completes a cycle. All the process are reversible.

i) Sketch the cycle in the P-V and T-S plane.
ii) Find the heat received and heat rejected in the cycle
iii) Efficiency of cycle. **(10 Marks)**

OR

10 a. State 'Dalton's law of partial pressure'. **(02 Marks)**

b. Define the following terms :

i) Saturated air ii) Wet bulb temperature
iii) Specific humidity iv) Dew point temperature. **(06 Marks)**

c. A mixture of gas has the following volumetric analysis. O_2 = 30%,CO_2 = 40%, N_2 = 30%, Determine : i) The analysis on a mass basis ii) the partial pressure of each component, if the total pressure is 100KPa and temperature is 32°C. iii) the molecular weight of mixture. **(08 Marks)**

* * * * *

CBCS SCHEME

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

15ME34

Third Semester B.E. Degree Examination, June/July 2019
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. Derive an expression for the extension of uniformly tapering circular bar subjected to axial load. **(08 Marks)**

b. A stepped bar made up of steel and brass in subjected to a pull of 30 kN as shown in Fig.Q1(b). Determine the deformation of each material and stress in each material. Take E_S = 200 GPa, E_B = 100 GPa.

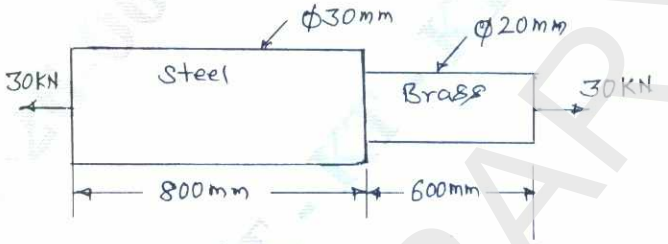

Fig.Q1(b) **(08 Marks)**

OR

2 a. Define: i) Young's modulus ii) Bulk modulus iii) Poisson's ratio iv) Thermal stress **(08 Marks)**

b. A bar of 20 mm diameter is tested in tension. It is observed that when a load of 37.7 kN is applied, the extension measured over a gauge length of 200 mm is 0.12 mm and contraction in diameter is 0.0036 mm. Determine: i) Lateral strain ii) Poisson's ratio iii) Elastic moduli E, G, K. **(08 Marks)**

Module-2

3 a. Define or explain (i) Principal plane (ii) Principal stress (iii) Plane of maximum shear (iv) Maximum shear stress. **(08 Marks)**

b. For a two dimensional stressed element shown in Fig.Q3(b), determine principal stresses, principal planes, maximum shear stress and maximum shear stress planes.

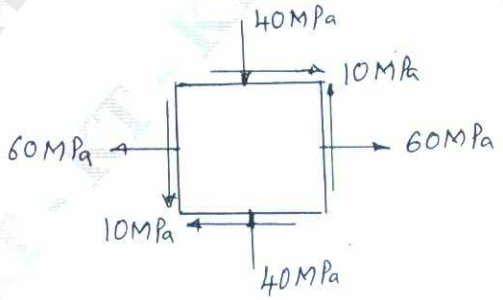

Fig.Q3(b) **(08 Marks)**

OR

4 a. Derive expressions for circumferential and longitudinal strains in thin cylinder. Hence show that volumetric strain $\epsilon_v = \frac{pd}{4tE}(5-4\mu)$ with usual notations. **(08 Marks)**

b. A thick cylinder of outside diameter 300 mm and internal diameter 200 mm is subjected to an internal fluid pressure of 14 MPa. Determine the maximum hoop stress developed. Also sketch the variation of hoop stress and radial pressure across the thickness of the cylinder. **(08 Marks)**

Module-3

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

b. Draw SFD and BMD for the overhang beam shown in Fig.Q5(b). Indicate all the significant values.

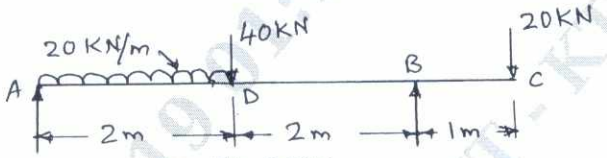

Fig.Q5(b) **(10 Marks)**

OR

6 a. Write bending equation and explain each notation with units. Also list the assumptions made in theory of simple bending. **(08 Marks)**

b. A cantilever beam of square section 200 mm × 200 mm, of length 2 m just fails in flexure when a load of 12 kN is placed at its free end. A beam of same material and having cross section 150 mm wide and 300 mm deep is simply supported over a span of 3m. Determine the minimum central point load required to break the beam. **(08 Marks)**

Module-4

7 a. Derive the torsion equation for a circular shaft with usual notations. **(08 Marks)**

b. A solid shaft is required to transmit 112.5 KW power at 150 rpm. The diameter of the shaft is 100 mm and length is 10 m long. Determine the maximum intensity of shear stress and the angle of twist. Take G = 82 GPa. **(08 Marks)**

OR

8 a. Derive an expression for Euler's critical load for a column whose both ends are hinged. **(08 Marks)**

b. A column of circular cross section of 50 mm diameter is 1.5 m long. One end of the column is fixed and other end is free. Determine the critical load using:

i) Euler's formula taking E = 120 GPa

ii) Rankines formula taking σ_c = 560 N/mm^2 and constant a = 1/1600. **(08 Marks)**

Module-5

9 a. State Castigliano's theorem I and II. **(04 Marks)**

b. Define strain energy and modulus of resilience. **(04 Marks)**

c. Calculate the strain energy stored in the bar shown in Fig.Q9(c) subjected to an axial force of 5 kN. Take E = 2 × 10^5 N/mm^2.

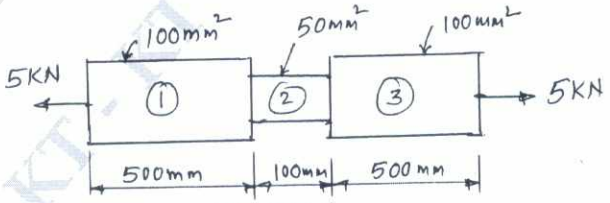

Fig.Q9(c) **(08 Marks)**

OR

10 a. Determine the deflection at the free end of a Cantilever beam of length L carrying a point load W at its free end. Use strain energy method. **(08 Marks)**

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

CBCS SCHEME

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

15ME35A

Third Semester B.E. Degree Examination, June/July 2019
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. With a neat [sketch] flowchart and explain the steps involved in casting process. **(08 Marks)**

b. What are pattern allowance? Explain any two pattern allowance with a neat sketch. **(08 Marks)**

OR

2 a. Explain with a neat sketch sheet mould and CO_2 mould process. **(08 Marks)**

b. Write down the advantages and limitations of green sand moulds. **(08 Marks)**

Module-2

3 a. Explain the construction and working principle of cupola furnace with a neat sketch. **(10 Marks)**

b. How the melting furnaces classified? Give the basis and list them. **(06 Marks)**

OR

4 a. Explain with a neat sketch the working of cold chamber die casting. **(08 Marks)**

b. Explain with a neat sketch the principle of a continuous casting process. **(08 Marks)**

Module-3

5 a. Explain the directional solidification needs and its methods. **(08 Marks)**

b. Explain degassing in liquid melt technology and sources of degassing. List out the degassing agents used. **(08 Marks)**

OR

6 a. Explain the sand casting defects causes, features and remedies. **(08 Marks)**

b. Explain with a neat sketch working and principle of stir casting techniques adapted for composites. **(08 Marks)**

Module-4

7 a. What is welding? Mention the advantages and limitations of welding process. **(08 Marks)**

b. Explain with a neat sketch TIG welding. Mention its advantages and limitations. **(08 Marks)**

OR

8 a. What are special welding process? How they are classified? What are the advantages and limitations of special welding process? **(08 Marks)**

b. Explain with a neat sketch the principle process and application of projection welding. **(08 Marks)**

Module-5

9 a. Write short notes on:
(i) HAZ (Explain heat affected zone with figure) **(05 Marks)**
(ii) What is Residual Stresses in Welding **(03 Marks)**
b. Mention the advantages and disadvantages of soldering and brazing. **(08 Marks)**

OR

10 a. Explain the inspection methods with sketches:
(i) Magnetic particle inspection
(ii) Radiography Technique **(08 Marks)**
b. Explain with a sketch of Oxy-Acetylene welding with application. **(08 Marks)**

* * * * *

CBCS SCHEME

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

15ME35B

Third Semester B.E. Degree Examination, June/July 2019
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. With neat sketch, explain working of horizontal milling machine. **(08 Marks)**

b. With neat sketch, explain working of capstan/turret lathe. **(08 Marks)**

OR

2 a. Write the classification of grinding machines. Explain any one type with neat sketch. **(08 Marks)**

b. With neat sketch, explain the working of horizontal boring machine. **(08 Marks)**

Module-2

3 a. Briefly explain any 4 types of milling operations along with sketch indicating different types of movements. Write down machining parameters and related quantities. **(08 Marks)**

b. Enlist the different gear manufacturing processes. Explain any one with neat sketch. **(08 Marks)**

OR

4 a. Briefly explain drilling, boring, counter boring and tapping operations with sketch, stating the applications of each operation. **(08 Marks)**

b. What are the different operations that can be performed on lathe? Explain briefly external threading operation or taper turning operation on lathe with necessary sketch. **(08 Marks)**

Module-3

5 a. A shaft of 50mm diameter is 600mm in length. What is the time required to reduce it to 46mm in 2 passes with the following given details. Also calculate total time for machining 100 such shafts.

i) Cutting speed = 50 m/min
ii) Feed = 0.5 mm/rev
iii) Approach length = 5mm
iv) Overturn length = 5mm
v) Loadings unloading time for 1 component = 1min. **(08 Marks)**

b. Calculate time for drilling a 10mm hole in a MS plate of 20mm thick. Cutting speed is 40m/min and feed is 0.2mm/rev. **(04 Marks)**

c. Enlist different types of cutting tool materials. Briefly explain the characteristics of cutting tool materials. **(04 Marks)**

OR

6 a. 5 holes of 20mm diameter are to be drilled in an MS plate of 30mm thick. The drilling is carried out in 2 steps. In the first step, holes of 12mm diameter are drilled and these are redrilled to 20mm diameter. Calculate machining time for 100 such components if setup time and loading time accounts for 1 minute/component. Cutting speed is 40 m/min and feed rate is 0.2 mm/rev. **(08 Marks)**

b. Identify the different elements in the following tool signature: 5 – 6 – 8 – 8 – 10 – 15 – 1. With neat sketch indicate different features of single point tool. Briefly explain the importance of rake angles. **(08 Marks)**

Module-4

7 a. With sketch, explain the phenomenon of chip formation and explain with sketch about any 2 types of chips generated in the machining operation. **(08 Marks)**

b. From the following data observed during an experiment on orthogonal cutting, determine the shear plane angle and fraction angle if the rake angle = 20°, uncut chip thickness, t = 0.125mm, cutting force component, F_n = 1100N, force component normal to it, F_v = 400N, cutting ratio = 0.42 **(08 Marks)**

OR

8 a. Explain about orthogonal cutting and oblique cutting with the help of sketch. **(06 Marks)**

b. In an orthogonal cutting operation on a material with shear yield strength of 200N/mm^2 the following data is observed:
Length of cut chip (l_c) = 50mm , length of uncut chip (l) = 100mm
Rake angle of tool = 10° , uncut chip thickness (t) = 0.2mm
Width of cut, b = 1.5mm , co-efficient of friction (μ) = 0.8
Determine shear plane angle, resultant force on the tool, horizontal cutting force component. **(10 Marks)**

Module-5

9 a. Explain flank wear and crater wear with necessary sketch. **(08 Marks)**

b. Mild steel bars of 50mm diameter are to be turned over a length of 150mm with a depth of cut of 1.5mm, feed of 0.2mm/rev at 230 rpm by HSS tools. If the tool life equation is given by $VT^{0.2} f^{0.3} d^{0.12} = 50$, determine how many components can be turned before regrinding the tool. Consider 5mm approach length and 5mm over turn length for calculating machining time. **(08 Marks)**

OR

10 a. Brief about different components of cost for simple turning operation. **(04 Marks)**

b. What is machinabiliy? Briefly explain any 2 criteria for machinability. **(04 Marks)**

c. A 50mm rod of steel was turned at 284 rpm and tool failure occurred after 10 minutes. The speed was changed to 232 rpm and tool failed in 60 minutes. What cutting speed should be used to obtain 30 minutes of tool life? **(08 Marks)**

* * * * *