SEMESTER: MONSOON
Examination & Semester: III Sem. B. Tech. (Common)
Subject: MATHEMATICS- III

SESSION: 2006-2007
Time: 3Hours
Max. Marks: 100

Instructions: (i) Use separate Answer Book for each section.
(ii) Figures in the margin indicate full marks.

Section-A
(Analysis of Complex Variable: 33 marks)

Question Nos. 1 to 4 are compulsory. Attempt any **Two** from the rest.

Q1. Show that the polar form of Cauchy –Riemann equations are

$$\frac{\partial u}{\partial r} = \frac{1}{r}\frac{\partial v}{\partial \theta}, \frac{\partial v}{\partial r} = -\frac{1}{r}\frac{\partial u}{\partial \theta} \qquad (5)$$

Q2. Evaluate $\int_0^{1+i}(x^2 + iy)dz$ along the path $y = x^2$ (4)

Q3. What type of singularities does the function $f(z) = \frac{e^{2z}}{(z-1)^4}$ have? (5)

Q4. Find the bilinear transformation which maps $1, i, -1$ to $2, i, -2$ respectively. Also find the fixed and critical points of the transformation. (5)

Q5. Evaluate $\int_C \frac{e^z dz}{(z^2 + \pi^2)^2}$, where C is the circle $|z| = 4$. (7)

Q6.Find the Laurent's expansion of $f(z) = \frac{7z-2}{(z+1)z(z-2)}$ in the region $1 < |z+1| < 3$ (7)

Q7. Evaluate $\int_0^\infty \frac{\cos mx}{1+x^2}dx$ (7)

Section- B
(Special Functions: 33 Marks)

Question Nos. 1 to 4 are compulsory. Attempt any **Two** from the rest.

Q1. Show that $J_{-n}(x) = (-1)^n J_n(x)$ when n is an integer. (4)

Q2. Show that $P_n(-x) = (-1)^n P_n(x)$ (5)

Q3. Express $\int_0^{\pi/2} \frac{dx}{\sqrt{\cos x}}$ in terms of elliptic integral. (5)

Q4. Express $J_4(x)$ in terms of $J_0(x)$ and $J_1(x)$ (5)

Q5. Solve in series $9x(1-x)\frac{d^2y}{dx^2} - 12\frac{dy}{dx} + 4y = 0$ (7)

Q6. Prove that

$$\int_{-1}^{1} P_m(x)P_n(x)dx = 0, m \neq n$$

$$= \frac{2}{2n+1}, m = n \qquad (7)$$

Q7. If

$$f(x) = 0, -1 < x < 0$$

$$= 1, 0 < x < 1$$

Show that $f(x) = \frac{1}{2}P_0(x) + \frac{3}{4}P_1(x) - \frac{7}{16}P_3(x) + ...$ (7)

Section C
(Laplace Transform & P.D.E.: 34 Marks)

Question Nos. 1 to 3 are compulsory. Attempt any **Two** from the rest.

Q1 Using Laplace transform, evaluate $\int_0^{\pi/2} te^{-2t}\sin(3t)dt$ (5)

Q2. Using Convolution theorem, evaluate $L^{-1}\left\{\frac{s}{(s^2+a^2)^3}\right\}$ (7)

Q3. Applying Laplace transform, solve $\frac{d^2y}{dt^2} + y = \sin(3t); y = 0, \frac{dy}{dt} = 0$ at $t = 0$ (6)

Q4. Find the solution of $\frac{\partial u}{\partial t} = k^2\frac{\partial^2 u}{\partial x^2}$ such that (i) u is not infinite when $t \to \infty$ (8)

(ii) $\frac{\partial u}{\partial x} = 0, x = 0$ and $\frac{\partial u}{\partial x} = \theta, x = l$ for all values of t (iii) $u = lx - x^2$ for $t = 0, 0 < x < l$

Q5. An infinitely long plane uniform plate is bounded by two parallel edges and an end at right angles to them. The breadth is π; this end is maintained at a temperature u_0 at all points and other edges are at zero temperature. Determine the temperature at any point of the plate in the steady state. (8)

Q6. Using variable separable method, solve

$\frac{\partial^2 y}{\partial t^2} = c^2\frac{\partial^2 y}{\partial x^2}$, representing the vibration of a string of length l, fixed at both ends, given that $y(0,t) = 0 = y(l,t)$ and $y(x,0) = f(x)$ and $y_t(x,0) = 0$, $0 < x < l$. (8)

6.	Derive the equation of the elastic curve of the simply supported beam (shown in Fig. 2). Macaulay's singularity function method may be used.	10
7.	A steel beam of inverted tee-section (as shown in Fig. 3) carries uniform bending moment of intensity 5 kN-m. Determine the magnitude and location of the maximum tensile and maximum compressive stresses.	10
8.	Find the dimensions of a hollow shaft with diameter ratio 3:4 that is required to transmit 60 kW at 200 rpm. The allowable shear stress for the shaft material is 100 MPa, and the angle of twist in a 4 m length should not exceed 3.8^0. Take G = 80 GPa. Give reasons for the acceptance of the shaft dimensions.	10
9.	Determine the allowable load for a 11 m long W 250 x 0.48 pin-pin ended steel column. The column is braced at the mid point in the weaker direction. For the wide flange section (shown in Fig. 4) the standard design section dimensions are : $A = 6.26 \times 10^{-3}$ m^2, d = 247 mm, t_w = 7.37 mm, b_f = 202 mm, t_f = 11.0 mm, $I_{XX} = 70.8 \times 10^{-6}$ m^4, $I_{YY} = 15.2 \times 10^{-6}$ m^4. Take E = 200 GPa, σ_p = 235 MPa and F.S.(=N) = 1.92	10

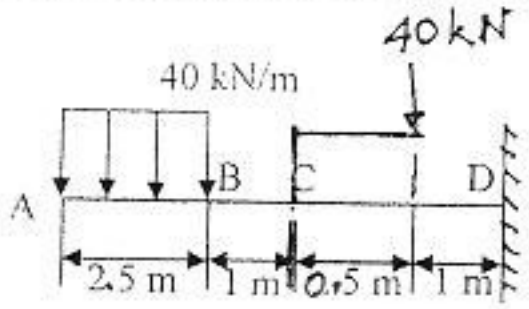

Fig. 1

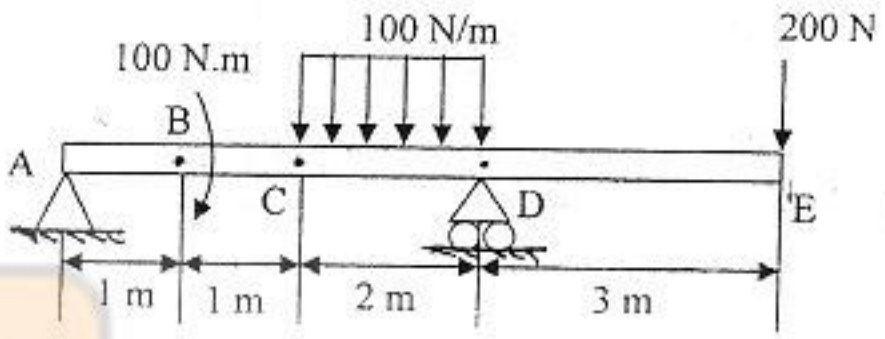

Fig. 2

Fig. 3

Fig. 4

EXAM. : III B.TECH. [MECH/ MME/ MIN/ PET / MLE] SEM. : MONSOON / 2006
Subject : MECHANICS OF SOLIDS Time : 3 Hours
Instructions : i. assume missing data (if any) suitably. Max. Marks : 100
ii. notations used have their usual meaning.
iii. answer to all parts of a question must be completed at a sequence for evaluation.

GROUP – A [ANSWER ANY TWO OF THE QUESTIONS]

Q.No.	QURSTIONS	Marks
1.(a)	The 2-D Mohr's circle representation for a stress state gives the principal stresses as $\sigma_1 = 6$ MPa and $\sigma_2 = -4$ MPa. Find the state of stress on the x-y plane element on which $\tau_{xy} = 4$ MPa. For the stress state find the maximum shear stress and associated normal stress values. Also find the orientation of the principal stresses with the x-y plane. Represent them on appropriate elements.	10
(b)	The strain values for a plane stress state, measured at a point on a 2-D surface are found to be $\varepsilon_0 o = -500\ \mu$, $\varepsilon_{45} o = +200\ \mu$ and $\varepsilon_{90} o = +300\ \mu$, $\mu = 10^{-6}$. Find the strain state in the xy directions. Hence find the principal stresses at that point. Take E = 200 GPa, $\nu = 0.3$.	10
2.	Draw the BMD and SFD for the loaded (as shown in Fig. 1) cantilever beam of 5 m length. Define the point of inflection or contraflexure.	20
3.	A circular shaft of tensile yield strength $\sigma_{yp} = 345$ MPa, carries a combined load: bending moment, M = 9 kN.m and a torque, T = 27 kN.m. Calculate the safe diameter, d of the shaft required to have a factor of safety, N = 2. For the purpose use (a) maximum principal stress, (b) maximum principal strain, (c) maximum shear stress and (d) maximum distortion energy theories. Use $\nu = 0.3$.	20
	GROUP – B [ATTEMPT ALL THE QUESTIONS]	
4.	A cylindrical airtank designed for zero longitudinal strain that has 750 mm outer diameter with 10 mm wall thickness to bear an internal gauge pressure of 1.2 MPa. Its welded end caps are hemispherical in shape with uniform wall thickness of 8 mm. Determine (a) the normal stress and the maximum shear stress in the end caps (b) the normal and average stresses in the cylindrical body part, (c) Draw the Mohr's Circles for the respective cases.	10
5. (a)	A close coiled helical spring has spring index = 10, n = number of active coils, D (in m) = mean coil diameter. For this spring, show that stiffness in N/m can be expressed as some constant times (D/n). Find the constant with the unit if G = 80 GPa.	3
(b)	The spring in part (a) is used to carry a maximum load of 1 kN with a maximum extension of 100 mm. Taking the allowable shear stress for the coil wire as 350 MPa find i) weight of the spring for specific weight, γ of the coil material as78 kN/m^3 (ii) the corresponding mean coil diameter (=D) and wire diameter (= d) and (iii) number of active coils.	7

Continued from page 1

Q. No	Question	Marks
	SECTION-B	
4.(a)	Define Kinematic link, kinematic pair, kinematic chain, mechanism And inversions	5
(b)	Describe various inversions of a slider-crank mechanism	7
5.	What is a gear train? What are its main types? Explain the procedure To analyse an epi-cyclic gear train.	12
6.(a)	Explain the working principle of internal expanding shoe brake.	6
(b)	What are the tooth profiles used in gear drive? What are its merits and Demerits?	6
7.(a)	Explain Corriolis component of acceleration.	4
(b)	Define : (i) prime circle and pitch curve of cam and follower mechanism; (ii) mobility of a mechanism; (iii) pressure angle of gear;	8
8.	Describe with the help of a neat sketch the construction and working of a prony brake dynamometer. Give the detail calculations involved in finding the power of an engine.	12

FORMAT FOR QUESTION PAPER

SEMESTER: Monsoon, SESSION: 2006-07
Examination & Semester: B.Tech. 3rd Semester
Subject: THEORY OF MACHINES Time: 3 hours
Instructions, if any: Answer any two questions from SECTION-A and all questions from SECTION-B. [redacted].

Max. Marks: 100

Q. No.	Question	Marks
	SECTION-A	
1.	The link AB of a four-bar linkage ABCD rotates uniformly at 120 rpm in a clock-wise direction. Find the angular acceleration of links BC and CD and acceleration of point E in the link BC. Given: AB=7.5 cm, BC=17.5 cm, CD=15 cm, DA=10cm, EC= 5 cm and angle BAD=90^0.	7+7+6
2.	Two gear wheels mesh externally and are to give a velocity ratio Of 3 to 1. The teeth are of involute form; module=6mm, addendum= One module, pressure angle=20^0. The pinion rotates at 90 rpm. Find: (a) Number of teeth on pinion to avoid interference on it and the corresponding number on the gearwheel, (b) The length of path and arc of contact, (c) The number of pairs of teeth in contact.	8+8+4
3.	Draw the profile of a cam operating a knife edge follower when the Axis of the follower passes through the axis of the cam shaft from the following data: (a) Follower to move outward through 40 mm during 60^0 cam rotation, (b) Follower to dwell for the next 45^0, (c) Follower to return to its original position during the next 90^0 cam Rotation, (d) Follower to dwell at the lowest position for the rest of the cam rotation. The displacement of the follower to take place with Simple Harmonic Motion during both the outward and the return strokes. The least radius of cam is 50 mm. If the cam rotates at 300 rpm, Determine the maximum velocity and acceleration of the follower during the outward stroke and the return stroke. (May be drawn on reduced scale)	10+5+5

Examination: III B.Tech (MLE); Session: 2006-2007; Marks: 100
Semester: Monsoon; Time: 3 hrs;
Subject: Economic Mineral Deposits and Ore Geology
Instruction, if any: (Answer any two questions from Part -I and all questions from Part II)

Q. No	Question	Marks
	PART-I	
1)	Write a note on the characterization of minerals giving examples in solving certain mineral beneficiation problems citing examples of either complex sulphides or gold ores with suitable flow charts.	20
2)	What are the different types of placer deposits and by which process they generally form, giving examples of some beach placer deposits of India. List out the commonly occurring heavy minerals (black sands) and conceptualize a suitable flow sheet for the liberation of the various heavy minerals.	20
3)	Briefly discuss classification of magmatic ore deposits. Explain how mineral deposits are formed by magmatic segregation process. Discriminate the Early Magmatic deposits with Late magmatic deposits. Where do you get such deposits in India?	20
	PART- II	
4)	Briefly describe **any two** of the following: a) Vickers Micro indentation hardness determination b) Twinning and zoning features in ore minerals c) Economic evaluation of ore deposits.	(2X7.5)=15
5)	Briefly discuss **any three** of the following: **a)** Distinguish between Granite and Basalt **b)** Distinguish between Sandstone and Shale **c)** Bowen's reaction series and d) Ore deposits formed by metamorphic process.	(3X5)=15
6)	Write a note on **any two** of the following; a) Optically distinguish Chalcopyrite-Pyrite-Gold. b) Describe geographical distribution of Bauxite and Iron ores in India; and c) Ore mineral paragenesis.	(2X5)=10
7)	Write briefly on some of the important textures observed in the economic minerals and their implication in mineral beneficiation.	10
8)	Explain in details the hydrothermal process of ore formation emphasizing their basis of classification and sources of hydrothermal fluids.	10